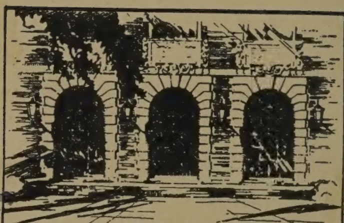
William Selby Church.



THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

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1860.

"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quelque soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

"................ per litora spargite muscum,
Naiades, et circùm vitreos considite fontes :
Pollice virgineo teneros hìc carpite flores :
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas ;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."

N. Parthenii Giannettasii Ecl. 1.

No. 25. JANUARY 1860.

I.—*Observations on the Distribution and Habits of the Pelagic and Freshwater Free-floating Diatomaceæ.* By Surgeon G. C. Wallich, M.D., Retired List, H.M. Indian Forces.

THERE are three important points connected with the natural history of the Diatomaceæ upon which the information hitherto recorded appears both scanty and unsatisfactory. These are—

The laws whereby the bathymetrical range of these organisms, in their living state, is determined;

The conditions under which their silicious remains are deposited and form vast sedimentary strata;

And, lastly, the extent and nature of their locomotive powers.

In the 'Synopsis of British Diatomaceæ' (vol. i. Introd. p. xiii.) their distribution and habits are thus described:—

"Their living masses present themselves as coloured fringes attached to larger plants, or forming a covering to stones or rocks in cushion-like tufts, or spread over the surface as delicate velvet, or depositing themselves in a filmy stratum on the sand, or intermixed with the scum of living or decayed vegetation floating on the surface of the water. Their presence may be often detected, without the aid of the microscope, by the absence, in many species, of the fibrous tenacity which distinguishes other plants; and when removed from their natural position, they

become distributed through the water, and are held in suspension by it, subsiding only after some little time has elapsed."

In the article on Diatomaceæ in the 'Micrographic Dictionary,' after a description of the methods for obtaining the fresh-water species "from the bottom, or from pieces of wood-work, &c., immersed in the water," it is stated that "many of them are entangled in the meshes of Confervæ and other Algæ, or on the submerged stems of higher plants,—*the deep-sea species*" being "obtained by dredging or by treating the alimentary canal of fishes, Mollusca, &c., with acid."

With two exceptions, immediately to be noticed, the above extracts embrace, as far as I am aware, a summary of the views entertained by writers on the subject; and they clearly indicate that none of the Diatomaceæ have, heretofore, been recognized as strictly free-floating organisms, but, on the contrary, that such forms as occur at times suspended in the water are considered as having been removed accidentally from their natural positions, and therefore evincing an invariable tendency to subside to the bottom.

Dr. J. D. Hooker was the first to notice the vast profusion of Diatomaceæ in the South Polar Ocean; and he pointed out their conspicuous appearance when imbedded in the substance of the ice or washed up on its surface by the action of the waves.

Still more recently, Assistant-Surgeon Macdonald, of H.M. Ship 'Herald,' in a brief but interesting paper on "Deep Soundings in the South Pacific" (published in the 'Annals of Nat. Hist.' for October 1857) offered the subjoined remarks on the subject:—

"Having ascertained with a certain degree of precision the nature of the material to be found in deep soundings off the coast of Australia and in the neighbourhood of the South Sea Islands, it is a discovery of peculiar interest to find the same minute organic forms, in vast numbers, mixed with the alimentary matter of Salpians and other pelagic animals observed in the open ocean, far distant from their shores.

"The presence of the silicious spicula and the fenestrated cells of *Thalassicolla* with the embryonic shells of the pelagic Mollusca might be readily accounted for. But how minute bivalves, Foraminifera, and a great variety of Diatomaceæ, and even Desmidieæ*, including the genus *Closterium*, and all apparently recent, could have been, as it were, casually inhaled, is not so

* In the plate accompanying Mr. Macdonald's paper, a *Closterium*-like body is represented, and referred by the author to the family named. A similar form has repeatedly been obtained by me from the same source. In external characters and colour it certainly exhibits the closest resemblance to a *Closterium*, but I was unable to detect either the terminal vesicles or the central suture.

easily explained. Such are the facts, however; and the means by which these bodies are so widely distributed are inscrutable, unless it be ultimately determined that they are in great part purely pelagic examples of the orders and genera to which they belong. This appears to be the most consistent view of the matter, seeing that the agency of drift-weed, or any other fortuitous cause, would be quite inadequate to produce so vast a result, even so far as mechanical dispersion is concerned, not to complicate the question with the more important part of the problem, namely, the preservation of the vitality and integrity of the beings under consideration."

I can most fully verify Mr. Macdonald's observations, having detected in the open sea, and widely distant from land or drift-weed, vast assemblages of minute animal and vegetable life, embracing every order to which he makes reference. My own observations, carried on during the voyage from Calcutta in the spring of the same year in which Mr. Macdonald's paper was published, led me to the following conclusions:—

That an inconceivable multitude of minute animal and vegetable organisms, the remains of which have been detected in deep-sea soundings, are, in their normal living state, strictly free-floating forms, inhabiting an extended bathymetrical range in the waters of the ocean. That the limits and variation of this bathymetrical range are determined by causes having reference partly to the condition of the atmosphere, and partly to the peculiar idiosyncrasy of the organism in question; the two sets of causes being influenced mutually, one by the other. That these floating pelagic forms constitute the principal source of food for the countless millions of minute animals which inhabit the open sea. And, lastly, that to the combined operation of such animals and those mightier zoophagists to whom the latter atoms afford, in their turn, a prolific prey, the submarine deposits of silicious and calcareous remains are, in a chief degree, attributable, the effects of natural death and decay being duly taken into consideration*.

* The late Professor Bailey of New York states (Journ. Microscop. Soc. vol. iii. p. 90) that Lieut. Berryman of the United States' Navy found "no trace of hard-shelled animalcules from specimens of water taken either at the surface or at any depths, at situations in close proximity to the places where the soundings were made, in the summer months, when animal life is most abundant;" and that "the animals present," some of which were, at the time of writing, "alive in bottles, were all of a soft, penetrable nature, leaving on their decay only a light flocculent matter, while the Foraminifera and Diatoms would have left their hard shells, if they had been present."

It is needless to say that these observations are quite inexplicable, unless on the assumption that the means necessary for the capture of all the smaller microscopic organisms were inadequate. At all events, a diametrically opposite result has been recorded by other observers.

Throughout the entire series of the two great kingdoms of nature, there is no class of objects so universally and lavishly distributed as the Diatomaceæ. In every latitude, on land and by sea, and under every known variation of temperature, wheresoever are combined the primary conditions of light and moisture, these minute but wondrously beautiful structures are to be found, in inexhaustible profusion.

Of their immediate purpose and uses we know little, as yet, beyond the bare fact that vast strata of the earth's crust consist more or less entirely of their silicious remains; that these strata have been formed, in bygone ages, as marine, fluviatile, or lacustrine deposits; and that, in our own day, similar strata are being gradually but incessantly built up, in the dark abysses of the sea-bed, far beyond the depths at which any living structures, with which we are acquainted, could meet with the conditions essential to their existence.

The strata referred to are, by some writers, described as "fossil" (or I should rather say that the Diatomaceæ discovered in those strata have been so considered),—an error at once obvious, from the fact of their silicious constituents existing now in precisely the same state as that in which they originally constituted the framework of the organisms by which they were eliminated and secreted.

This is a material point; and I am desirous of laying stress upon it, inasmuch as I conceive the deposits under notice not to be dependent wholly, or even chiefly, on the subsidence of these silicious frameworks, as the sequel to ordinary death and decay, but on the living structures being subjected, in numberless multitudes, to the processes of digestion; whereby, being divested of the bulk of the particles possessing any buoyant tendency, the mineral remains subside, by their own specific gravity, to the regions wherein they are finally entombed.

Some faint conception of their numbers may be gathered from what we see in the guanos, which present a considerable percentage of Diatomaceous exuviæ, and are thereby enhanced in commercial value. In most descriptions of the sources from whence the silicious element in guano is derived, it is stated that the birds producing this kind of deposit feed directly upon Diatomaceæ. Professor Carpenter suggests that the birds must have received these minute particles from the "shell-fish to which they serve as ordinary food."

Professor Quekett, in a paper on "The Examination of Guano by the Microscope" (Trans. Microscop. Soc. vol. ii. p. 29), thus writes:—"The silicious animalcules and sponge-spicules, it would seem, become present in the guano from, firstly, being devoured by fishes whilst adhering to sea-weeds or mingled with

the sand; and, secondly, the fishes being devoured by the birds, they are voided with the excrementitious matter of the latter. As the guano localities are always above the level of the sea, and the species of animalcules yet discovered are all of the character that inhabit the bottom of the ocean, the most probable reason for their occurrence is that above described."

Now, with one or two rare exceptions, it would be easy to show that no Diatomaceous frustules exist of sufficiently large size to come within the focus of any bird's eye whatever. Nor could any vertebrate animal we are acquainted with, by any possibility, gather together, within a reasonable period, a sufficient supply of such infinitesimal nourishment as the Diatomaceæ afford, even granting that the optical difficulty were in any manner overcome. Again, no animal is known to possess prehensile or masticatory apparatus of sufficiently delicate arrangement to enable it to deal with particles so minute. The presence of Diatoms in guano, therefore, cannot be said to result from their constituting a direct source of food to the birds in question, but from their being the main source of food to the countless minute animals and animalcules, from the Crustacean and Mollusk down to the humblest hydrozoic being, on which the feathered tribes of the open sea depend for diet.

Touching the position assigned by Professor Quekett to the living representatives of all species whose remains have been found in the guanos, and assuming that the Diatomaceæ were included under the term "animalcules" (which was almost universally applied to these organisms at the time the paper referred to was written), it is only necessary to mention that in no instance have living Diatoms been brought up, by the sounding apparatus, from extreme depths. Frustules have been frequently obtained, containing the remains of the endochrome. But this proves nothing beyond the fact that the water, at those great depths, is so highly charged with saline particles as to render it capable of preserving, for an indefinite period, such portions of animal or vegetable matter as may sink to the bottom. It is highly probable, moreover, that, putting aside the Foraminifera, Polycystina, and Diatomaceæ, whose softer portions are included within a rigid mineral shell, nothing but the bleached skeletons of all the higher organisms ever reaches the bed of the ocean, every soft atom being resolved into its elements, either mechanically or chemically, long before it sinks to its final resting-place.

In the lowest forms of animal life, the absence of one set of functions is counterbalanced by the introduction of another. We thus find that a simple ciliary apparatus, working continually in the midst of an inexhaustible profusion of alimentary

matter, answers all their requirements, and prepares them, in due course, to become food for creatures far removed from them as regards complexity of structure.

The pelagic Diatomaceæ have hitherto escaped detection chiefly because the means employed for the purpose have been inadequate. Indeed, their detection at all may be said to have been the result rather of accident than of any systematic endeavour to trace out the boundaries of their distribution.

The Diatomaceæ abound in all waters, more or less, but nowhere in such vast profusion as in the open ocean. Their presence there is in nowise accidental, or necessarily associated with that of foreign floating bodies, such as drift-weed, wood, &c. &c. It is well known that a large class of Diatoms consists of what are called "free forms," that is, of frustules possessing neither stipes nor mucous cushion or pedicle of any sort, whereby they might attach themselves to, or derive support from, other bodies; and that they are moreover endowed with a very peculiar and remarkable power of motion.

To these "free forms" belong the Diatomaceæ of the open sea; and there cannot be a doubt that the numbers in which they exist, in all latitudes, at all seasons, and at all depths (extending from an inch to the lowest limit at which the most attenuated ray of light can penetrate, or at which pressure permits), are immeasurably in excess of what we have hitherto been in the habit of assuming.

Nothing is more perplexing to the collector, at sea, than the apparently capricious manner in which the minute forms of organic life, both vegetable and animal, present themselves in and disperse from the surface waters. I have repeatedly observed the upper portion of the sea to burst forth suddenly, as it were, into a swarm of living particles, and these again as capriciously and suddenly to disappear. At one time, a slight change of temperature, or wind, or cloud, brings about such a result; at another, it follows upon influences unappreciable perhaps to our organs of sense, but at once indicated by barometric changes. During calms and bright sunshine, as might be anticipated, the assemblages of these vast masses of life are most frequent and constant, and especially so in the case of the Diatomaceæ; but this is by no means the invariable condition, as shall presently be shown.

My attention was, in the first instance, drawn to these remarkable objects by the phænomenon which presented itself in the Bay of Bengal and Indian Ocean, in March and April 1857. This consisted of an immense multitude of small yellow flocculi and tufts, with which the surface of the sea for some depth was crowded in sufficient quantity to impart to it a faint

tint,—these tufts being intermixed with numerous glistening cylindrical bodies of a similar colour. A succession of calms, following one on the other, enabled me to trace this phænomenon, with but slight intermission, from 18° North lat. to 24° South.

On the Atlantic side of Africa the tufts alone were to be seen, and in smaller quantities, as might be expected from the stormy character of the sea. Without entering into a detailed description of these forms, I will merely state that the tufts were of two kinds,—one consisting of cylindrical filaments, closely resembling *Trichodesmium* in character; the other, of filaments of a *Rhizoselenia**. The flocculent masses, which when seen floating on the water resembled flakes of yellow cotton, were from half an inch to two, or even three inches in length, and proved to be aggregations of filaments of the same genus. The cylindrical bodies were gigantic *Coscinodisci,* each disk being distinguishable at a considerable distance from the eye, and even for several feet below the immediate surface.

I was at first induced to refer the whole of the tufts and flocculent masses to the Confervoid growths described as frequently occurring in the Red and Yellow Seas in such profusion as to tinge their waters of a reddish-yellow colour. The examination of the *Trichodesmium*-like tufts, which happened to come first under my notice, confirmed this view for a time; and it was not until a more extended analysis revealed the presence of the silicious forms, that the true character of the latter became apparent. *Salpæ* and *Diphyes,* taken previously in the upper portion of the Bay of Bengal, had already brought to light a considerable number of Diatomaceæ, specimens of which were now to be found entangled in the tufts and flocculi alluded to, imbedded in the substance of *Thalassicollæ,* or abundantly distributed in the alimentary matter procured from Salpians and other small creatures.

The mighty scale on which the Diatomaceæ really exist did not become manifest, however, until we reached the Atlantic, between the Cape and St. Helena.

It was here that, for many degrees, and in bright breezy weather, the ship passed through vast layers of sea-water so thronged with the bodies of a species of *Salpa* (*S. mucronata*) as to present the consistence of a jelly. These layers extended for several miles in length. What their vertical limits were, it was impossible to discover, owing to the speed at which the ship was moving. They appeared to extend deep, however, and in all

* This genus, as originally established by Ehrenberg, comprises forms widely distinct from the genus as now circumscribed by Mr. Brightwell of Norwich, and referred to above (Quart. Journ. Microscop. Soc., vol. vi. p. 93).

probability were of a similar character to the aggregations of what is called whale-food in the higher latitudes. Each of these *Salpæ* measured about half an inch in length; but so close was their aggregation, that, by a sudden plunge of an iron-rimmed towing-net, half the cubic contents, from which all water had percolated, generally consisted of nothing but one thick gelatinous pulp. Each individual presented a minute yellow digestive cavity, of the size of a millet-seed, which contained both Diatomaceæ, Foraminifera, and other organic particles.

If we take into account the numbers of Diatomaceæ and Foraminifera that must exist in order to afford even a small integral proportion of the diet of these creatures,—the vast renewal of supply that must be perpetually going on, and the equally vast multitude of these Diatom-consumers that yield, in their turn, a source of food to the gigantic Cetaceans and other large creatures of the sea,—it becomes possible, in some measure at least, to form an estimate of the manner in which the deep-sea deposits become accumulated.

Although no detailed investigations have up to this time been carried out with the special view of determining the bathymetrical ranges at which the Diatomaceæ, Foraminifera, and Polycystina of the soundings may be said to live, sundry vague and conflicting opinions have, here and there, been elicited during the recent inquiries into the nature of the sea-bottom, instituted under the auspices of the British, the Dutch, and the United States' Governments.

These opinions bear reference, however, almost wholly to the original habitats of such Foraminifera and Polycystina as have been traced in the soundings,—it being asserted by some that they lived and died at extreme depths, near the positions in which their shells were discovered; whilst by others it is contended that, having passed their lives in the various littoral regions of the ocean, their indestructible remains were gradually borne away by currents toward the situations at which they ultimately rested.

It is a notable fact, that both in guanos and deep-sea deposits the discoid forms of Diatomaceæ generally preponderate. In some deposits, as is well known, they constitute almost the entire silicious element, although frequently mixed with the calcareous exuviæ of Foraminifera, which, from their greatly superior size, form a large percentage of the mass. The abundance of *Coscinodiscus* in the Indian seas has already been adverted to; and, from observations made by me more recently amongst the Channel Islands, it appears highly probable that this form is the most largely distributed of the pelagic Diatomaceæ.

In contradistinction to the discoid forms, those of Naviculoid

figure (using both these designations in their broadest sense) were comparatively scarce both as to species and individual numbers, and presented characters distinct from their non-pelagic congeners.

In the contents of the stomach of *Salpæ* and *Diphyes*, the discoid examples were numerous, although not of large size, as might be expected*. Among these may be named *Coscinodiscus*, *Eupodiscus*, *Asterolampra*, *Asteromphalus*, and *Triceratium*.

Rhizoselenia was always abundantly detected, but nowhere so profusely as in the mid-Atlantic, where the digestive cavities of monstrous *Salpæ*, measuring from six to seven inches in length, contained little else.

Temperature, within certain limits, has probably little to do with the bathymetrical distribution of the pelagic Diatoms; for it is well known that, whereas in the equatorial regions the temperature decreases with the depth, at a tolerably fixed rate, until it becomes stationary (or only subject to slight variation) several degrees above freezing-point,—in the Polar region the converse process takes place, the temperature increasing from above with the depth, and approaching to the standard which is probably universal near the bed of the ocean.

The question to what extent the subsidence and deposit of minute organic remains may be influenced by oceanic currents, can hardly be considered as bearing on the present subject. It will be a point for future investigators to decide, how far the results observable in such a case can be rendered expressive of their causes. Or, should this, in its literal sense, appear a visionary hope, we may, at all events, expect, by examining facts as presented, to augment our practical knowledge of the sea, and, with it, our means of verifying other and more palpable phænomena.

Again, it seems highly probable, from what has been adduced, that these vast aggregations of minute vegetable life, and (what is of equal value as affording collateral evidence of their presence *somewhere* in the neighbouring depths) of the minute creatures which subsist upon them, exist in different vertical zones, which are partly determined by atmospheric conditions, and partly by peculiar idiosyncrasies of the organism upon which those atmospheric conditions operate.

In the present state of our knowledge of their life-history, anything beyond a notice of the most easily recognized and demonstrable of these conditions would be futile. Nevertheless I shall endeavour to show that, as regards the Diatomaceæ,

* The *Coscinodiscus* referred to as being so conspicuous in the Indian waters is probably the largest Diatom known, the valve at times measuring one-twentieth of an inch in diameter.

certain well-known laws, which influence the vegetable kingdom generally, exercise an additional and very powerful influence in their diffusion from one bathymetrical zone to another; and that, too, apart from the peculiar inherent power of locomotion exhibited by this remarkable class of organisms.

Light and moisture constitute the indispensable requirements of the Diatom. Without these, its vitality at once ceases. But these requirements are essential only in a very modified degree. In other words, an amount of either so limited as to annihilate every trace of life in the higher types, is not only capable of sustaining that of these lowlier ones, but of sufficing for every purpose of luxuriant growth and reproduction.

It is impossible not to be struck with the exuberant and rich development of endochrome seen in all the floating frustules. Nothing can exceed the vividness of colour or massiveness of the endochrome-granules in the several species observed. The frustules procured direct from the water were invariably full of these particles, whilst such as were obtained, at second hand, from the digestive canals of the minute phytophagists within whose bodies they were found, exhibited the frustules in every condition intermediate between that just described and emptiness—the exponent of accomplished digestion. In the latter case we have the state in which the silicious skeleton is extruded and now permitted slowly but surely to accomplish its journey to the bottom.

How far these minute frustules may have travelled from that point at which, succumbing to the limits imposed on their individual existence, or captured as food, they first began their descent as mere motionless atoms, it would be vain to surmise. One thing is certain—that, to whatever extent their ultimate destination may have been influenced by the mightier and more determinate currents of the ocean, they must also have been swayed to and fro, for indefinitely protracted periods, by those numberless fainter heavings which, although unmarked by the plummet, are nevertheless all-powerful in relation to such particles.

The spores of the freshwater Algæ afford evidence of the wonderful amount of vital resilience, so to speak, with which these structures are endowed,—being capable of withstanding long-protracted periods of desiccation under tropical heats, or congelation under Arctic cold, without losing those reproductive energies in the absence of which their tribe would be annihilated. This power belongs in a very marked manner to the sporangia of the Desmidiaceæ and Diatomaceæ, as is well known. In all probability, therefore, the pelagic Diatomaceæ possess some equivalent property, in virtue of which they can the more readily

accommodate themselves to the varying, but mighty, agencies of the ocean.

The tendency of the Diatom to approach the source of light and heat is fully understood. It shares that tendency with all other vegetable structures, although, from the fixed nature of the higher orders, the effects are perhaps not so palpably recognized. But there exists, it appears to me, quite sufficient evidence to prove that this quality is entirely distinct from, and independent of, the peculiar motile power upon which its animal character was so long and so erroneously maintained. The one phænomenon is simply the result of those physical conditions by which the growth and increase of the organism are determined; the other depends upon peculiarities of structure or function which, although imperfectly understood, must nevertheless be considered as imparted to it for the purpose of bringing it into contact with fresh portions of the medium it inhabits, or of enabling it to accommodate itself to the requirements of the conjugative process.

Last year, among the Channel Islands, it was my good fortune to meet with a repetition of the phænomenon witnessed by me in the Indian seas. As in the former instance, my attention was first attracted by the occurrence, during calm spring weather, of large frustules of a *Coscinodiscus*, viz. *C. concinnus*. The surface and depths, as far as the eye could pierce from the gunwale of a boat, were thronged with the brilliant, glistening cylinders of this Diatom, intermixed with filaments of *Biddulphia Baileyii*, and, more sparingly, with the long acicular threads of *Rhizoselenia* and *Chætoceros*. The self-buoyant property of these coast-frequenting forms, although of a temporary character only, is nevertheless evident, and indicates that they hold a position intermediate between the perpetually free-floating species of the open sea and the subparasitic species of the fresh water, which, although capable of self-support for brief periods, are generally to be found in the neighbourhood of aquatic plants or other objects.

As it happens, *Coscinodiscus concinnus*, *Biddulphia Baileyii*, and the several species of *Rhizoselenia* are amongst those forms sometimes designated as "imperfectly silicious." Their distinctness as species can, however, in nowise be influenced by this character. The quality of the silicious framework is, after all, resolvable into a question, not of imperfect (that is, impure) silicious secretion, but of the relative thickness and solidity of that secretion in these as compared with other forms. If it be for a moment contended that the silicious structure is *permeated* by any structure of vegetable origin, whether protoplasm or endochrome, or cellulose, the only consistent view of

the silicious portion of the frustule must at once be set aside. Professor Bailey's observations with reference to the behaviour of the Diatom when treated by hydrofluoric acid are conclusive on this point. The *external* silicious framework is consumed. The internal cellulose cell-membrane remains intact, leaving no trace of any delicate network, such as we should certainly find were it associated with the substance of the silicious portions. On the other hand, the substance of the silicious valves (after being subjected to hydrochloric and nitric acids) *in no case* exhibits evidence of permeation by other matter.

The frustules of certain species, it is true, are more readily broken up under the action of acid; but under no circumstances can nitro-muriatic acid *destroy* a film of silica, however delicate.

Forms accidentally removed from their natural habitats, and thereby placed under conditions for which they are unfitted, naturally enough, present examples of imperfect deposition of silex, as to *quantity*, but not as to *purity*. Such a state occurs in freshwater forms exposed to brackish water, or *vice versâ*. But these are exceptional cases, and cannot be allowed to weigh in our estimate of normally developed forms. As regards the Diatoms more particularly noticed as falling under the modified silicious examples, it is only necessary to state that specimens subjected to boiling, for many hours, in the most concentrated acids, in no single instance presented appearances which could be interpreted into an obliteration of the silicious envelope.

The true significance, I would suggest, of the delicate nature of the silicious element in the Diatomaceæ under review consists in a simple adaptation of the means to the end—in the lightening of the mineral framework as far as is compatible with the requisite strength, and its being made to enclose the greatest possible space, in order to admit of that luxuriant development of the endochrome and protoplasmic contents, in virtue of which the specific gravity of the frustule is diminished and its buoyancy secured.

Light and pressure seem to be the main causes that impose limits to the wanderings of these organisms. It has been shown that their buoyancy must vary with the intensity of the conditions necessary to their development; and we are justified in concluding, moreover, that there are periods in the history of the structure at which their development and reproductive phænomena proceed most vigorously. Their bathymetrical position must therefore also be a fluctuating one; and we can thus satisfactorily account for the seemingly capricious manner in which they approach, or disappear from, the surface of their element.

We have therefore before us an answer to the problem, why these organisms appear near the surface more readily in calm and bright weather. It is only during such conditions of the atmosphere that the refractive power of the medium they inhabit remains undisturbed by the surface-tumult; the rays of light and heat penetrate freely into the depths, and produce, by their combined influence, the amount of development under which the ascent to the surface takes place*.

It will be obvious that buoyancy and development of endochrome must proceed *pari passu*, when we recollect that the silicious skeleton, once formed and consolidated, ceases to grow, and therefore that the increase of the lighter contents must materially diminish the specific gravity of the entire frustule.

Of course the development of the freshwater forms depends on precisely the same laws as that of the pelagic ones; but their buoyancy is constantly obscured by entanglement amongst Algæ and other bodies mixed with the water in which they reside. There are two easily available modes in which the buoyancy of certain freshwater species, and the powerful light-seeking tendency of others, may be tested. The first consists in carefully scooping up, during bright sunny weather, a portion of the water in the immediate neighbourhood of the larger Algæ; the second, in watching how rapidly the mud-inhabiting species cover a muddy bank (which, during stormy weather, exhibited not a single frustule) with a uniform layer of glistening and satin-like yellow.

Lastly, the spaces frequently traversed by the Diatomaceæ are such as to be quite irreconcileable with the ordinary alternating to-and-fro motions they exhibit; for, even granting that this kind of motion were capable of being continuously exercised in any given direction, the speed achieved by it would be quite disproportionate to the distances travelled over.

Having thus far endeavoured to trace the influences which determine the general limits of the Diatom as to depth, and its transition from one bathymetrical range to another, it remains for me to state the result of an extended series of observations, conducted with a view to ascertain the precise agency whereby the ordinary motile power of the free species is produced.

Did space permit, or were it necessary after what has fallen from the pen of the late Professor Smith on the point, I might

* It is well worthy of note that the ordinary to-and-fro movements of the Diatomaceæ appear to be carried on quite as energetically under artificial as under solar light. But artificial light does not bring them to the surface as solar light does,—clearly proving that the ascent of the free-floating forms from the depths is *not* due to the ordinary motile power of their frustules.

discuss the statement of Professor Ehrenberg as to his having seen "moveable retractile cirrhi," on a species of *Surirella*, bearing a resemblance to "the feet of the sea-stars," by which locomotion was effected.

As it is, I would observe that, having repeatedly seen the peculiar appendages described by Professor Ehrenberg and recognized by Professor Smith, I have shared the inability of the last-named high authority to distinguish the slightest evidence of motile power. Prof. Smith states that he never saw the appendages *move*. In so far as relates to their being deflected, one after the other, during the transit of the frustule to which they were attached past impeding objects, I have certainly seen *movements*; but these movements were precisely of a character to furnish the most conclusive proofs *against* their being *organs of locomotion*, or indeed anything more than epiphytic appendages which, like the teeth of a comb, when drawn across an object, become the exponents and not the source of the force employed.

Before proceeding further, I must avow that, whilst I am prepared to indicate the *kind* of organs possessed by the Diatomaceæ, I have hitherto failed in rendering them visible under the microscope, even with all the delicate appliances of an instrument of the most perfect construction.

In venturing to prove my position, I rely on two facts: viz. that the hypothesis offered is sufficient to account for the entire series of phænomena, and that the phænomena observed are wholly irreconcileable with any other hypothesis.

Under this difficulty, I may perhaps be permitted to record, in the first place, the several conditions under which the living Diatom may be seen to move and to *exert an influence upon* minute particles in its course; and then to point out the nature of the organs by which alone I conceive those conditions can be effected*.

The normal motion of the Diatomaceous frustule is in two opposite directions, which accord with its longest diameter. It is of a smooth, gliding nature, devoid of jerks or interruptions, and exhibits itself at tolerably regular intervals. The rate at which it travels is not uniform, being subject to variation on increase or diminution of light and warmth. The rate is also materially influenced by the condition of the endochrome, the motions being invariably more active and energetic when the frustule is full. On the other hand, as soon as the contents shrink, and more especially on the appearance of vibratile

* The appearances about to be described may be readily seen in any of the commoner Naviculoid species. If kept in saucers for a day or two, they will rise to the surface, in a sufficiently pure state to admit of accurate observation.

granules, the movements become either wholly or partially arrested.

The power of turning on the long axis also exists, and, further, of wheeling round on the centre abruptly. It is probable, however, that this last kind of motion is effected only when the frustule happens to be obstructed in its course by foreign particles, or between the glass slide and cover of the observer. When thus impeded, the smooth gliding character of the motion becomes destroyed, and in its place may be seen a somewhat "drunken" or, at times, jerky progress. This, although evidently due to the abnormal position in which the Diatom happens to be placed, proves of the highest value, as will be presently understood, in arriving at a proper view of the question before us.

When a frustule comes into contact with particles of matter in its vicinity (as constantly occurs whilst it is under the eye of the observer), it either cleaves its way steadily and slowly through them, or, by a series of abrupt jerks, becomes freed from the obstacles, and continues its progress, with perhaps some slight change of its original direction. Should the particles prove too heavy for its powers, or too firmly fixed, the jerks nevertheless are continued, until, on the recurrence of the retrograde interval, the frustule reverses its direction and retires from the obstructing particles.

But, instead of merely thrusting aside a particle in its way, the Diatom may frequently be noticed to seize upon it, and carry it along with it for an indefinite period on one or other of its surfaces—often, moreover, in an opposite direction to that pursued by the frustule for the time being. It is not by any means essential that the particle laid hold of should be placed directly in its path, or even very close to it; for, at times, without any connecting bond of union being detected, the particle is forcibly drawn towards the moving frustule, and is either released after a while, or subjected to the handling above referred to.

The Diatom may, again, pass over, or under, or through a mass of impeding objects, and may appear for a time as if it had got clear of these. Such is not the case, however. When it has advanced *to some distance*, the particles are suddenly observed to be bound together, as it were, and to follow accurately in the wake of the frustule, the relative positions and distance being accurately maintained. Should the frustule, with its particle or particles "*in tow,*" now meet with any sudden impediment, the instant it is checked in its course, so is the particle,—every jerk, turn, and movement of the body dragging being synchronously and faithfully repeated by the particle dragged.

Having been "towed" along as just described, the particle may all at once be suddenly drawn towards or upon the Diatom, when similar phænomena to those above noted are perhaps again repeated.

At times the course of events is changed. The Diatom cleaves its way, and evades or pushes through an obstacle which is sufficient to check the particle it happens to be dragging behind it. We now see the Diatom suddenly arrested, at the *precise* instant that the obstacle is observed to take effect upon the particle. Again the Diatom jerks, as if endeavouring to free the obstructed particle by dragging it through the obstacle, and again every jerk and movement are most faithfully repeated by the particle in tow and also by the obstacle it is impeded by. Should the force exercised prove insufficient to release the particle, one of two events occurs:—either the bond of union, whatever it may be, appears suddenly to break or relax, and the Diatom springs forward on its course; or, at the end of the usual alternating interval, the bond of union being still retained, the frustule retraces its steps.

In this last event, a very remarkable phænomenon may be witnessed. The Diatom either manages to pierce or to evade the obstacle which impeded the particle it had "in tow," and frees it by causing it to recede from instead of advancing through the obstacle; or, having released its hold, it advances alone, leaving the particle motionless. Sometimes the Diatom appears to "anchor" itself to a spot, and the particle, should one be retained "in tow," instantly stops. But, although at a considerable distance, it may be observed to experience jerks and movements utterly incompatible with any forces except such as *must* originate with the Diatomaceous frustule. Or, although the frustule is evidently anchored in some way, and thus enabled, generally speaking, to withstand the recoil shock or jerk due to the force it has applied, the unmistakeable connexion between some jerk of the particle it is applied to and the corresponding recoil the frustule exhibits leaves no possible room to deny the sequence of the two events as cause and effect. And, lastly, the whole of the above phænomena may occur between a frustule and one or many such particles of matter.

These, then, constitute some of the most striking appearances which bear directly on the problem before us. In avoiding the complications that must have arisen had I attempted to depict all the modifications they are liable to under a variety of accidental circumstances of no significance one way or the other as relates to the point to be proved, I should have become simply unintelligible.

The view entertained by Professor Smith, and indeed by the

generality of authorities, respecting the movements of the Diatomaceæ, may be best stated in the paragraphs from the 'Synopsis' (vol. i. p. xxiii):—

"Of the cause of these movements I fear I can give but a very imperfect account. It appears to me that they do not arise from any external organs of motion. The more accurate instruments now in the hands of the observer have enabled him confidently to affirm that all statements resting upon the revelations of more imperfect object-glasses, which have assigned motile cilia or feet to the Diatomaceous frustule, have been founded upon illusion and mistake. Amongst the hundreds of species which I have examined in every stage of growth and phase of movement, aided by glasses which have never been surpassed for clearness and definition, I have never been able to detect any semblance of a motile organ.

"I am constrained to believe that the movements of the Diatomaceæ are owing to forces operating within the frustule, and are probably connected with the endosmotic and exosmotic action of the cell. The fluids which are concerned in these actions must enter and be emitted through the minute foramina at the extremities of the silicious valves; and it may be easy to conceive that an exceedingly small quantity of water expelled through these minute apertures would be sufficient to produce movement in bodies of so little specific gravity."

Had it only been necessary to explain the ordinary and separate movements of the Diatomaceous frustule, the theory of endosmotic and exosmotic action might perhaps have been deemed satisfactory. But the moment we come to consider the behaviour of the frustule with reference to minute objects in its vicinity, and duly interpret the phænomena I have endeavoured to describe, and which are inseparable as cause and effect, it becomes evident that no such action can, by any possibility, account for them. To explain such phænomena consistently, we are irresistibly, as I conceive, led to one inference, namely, the existence of elongated prehensile filaments, capable of alternate extension and retraction, of extreme tenuity, yet of extraordinary strength and elasticity,—in virtue of which both the ordinary to-and-fro motions and the secondary motions affecting surrounding bodies are performed.

All "free" Diatomaceæ may be held to possess these organs. But where they emerge, whether they arise in one, or two, or several pairs from each valvular extremity, and whether they are to be considered as processes sent out from the primordial utricle, it would be foolish, at present, to hazard an opinion.

If it has not been deemed rash to assume the existence of

endosmotic and exosmotic action in solving the problem before us, surely it cannot be so to assume that of prehensile organs of the kind shadowed forth. In the one case the alternating action in opposite directions has no parallel. On the contrary, looking at the unicellular nature of the Diatomaceous frustule, we are at once met with strong negative testimony. Not so, however, with regard to the motile filaments; for we are presented with analogous phænomena in the spores of certain Acrogenous plants, which move from place to place by the alternate expansion and contraction of the hairs with which they are furnished.

Or, if we are inclined to admit an analogy between the prehensile and motile organs now spoken of and the pseudopodia of the Rhizopods—or, to go yet a step further, if we look at the contractile pedicels of certain Infusoria, we are provided with examples from the animal kingdom of the occurrence of similar, or very nearly similar organs.

From the character of the primary movements of the Diatom, and those secondary movements which are produced by its instrumentality on objects in its neighbourhood, it is highly probable that the prehensile and active portion of the organs is chiefly confined to their extremities,—their stem being somewhat rigid, and thereby unfitted to create currents amongst minute foreign particles at its point of exit. Of filaments of this nature we have examples, although on an enlarged scale, in certain Monadina (*Monas attenuata*, for instance), and certain Euglenæ, such as *Peranema globulosa*. By such organs we might naturally expect to see particles in the vicinity of a Diatom grasped and swayed about, precisely as occurs in reality, at the same time that the ordinary motions are produced.

Professor Smith has stated that, on colouring the water with "carmine or indigo, he had never been able to detect in the coloured particles surrounding the Diatom those rotatory currents which indicate, in the true Infusorial animalcules, the presence of cilia." But, surely, had endosmotic and exosmotic action been the real source of motion, similar currents *ought* to have attended the *expulsion* from the apertures of even so small a quantity of water forcibly enough to create those movements.

The same writer has also stated (Synops. vol. i. p. 23) that "motion may at times be detected in other forms than the free species; as those of *Gomphonema*, when forcibly separated from their stipes, occasionally exhibit an evident tendency to change their position;" but that such motions are devoid of the *isochronous* quality so notable in the others.

This is precisely what might be looked for, as I conceive the

stipes and cushion-like masses of the pedunculate and filamentous forms to be merely modifications of the filament in one or both directions; and it is highly probable, therefore, that the remarkable unsymmetrically arranged processes referred to by me (Quart. Journ. Micr. Science, vol. vi. p. 423) as occurring in both species of the genus *Hydrosera*, and also to be found in several Indian stipitate forms, are in reality apertures, through which the modified filament is extended. Of course, in the discoid forms, the marginal processes would perform the same office*.

In *Bacillaria paradoxa* we have to assume the presence of a *highly* elastic envelope, embracing the entire filament, to enable us to conceive how the several series of prehensile filaments may produce the curious movement which that form exhibits. That such envelopes are to be found both amongst the Diatomaceæ and Desmidiaceæ, is well known. And in proof of the elastic character which analogous structures may possess, it is only necessary for me to state that, from observations made by me on an Indian species of *Schizonema*, the character spoken of was remarkably seen in the enveloping gelatinous sheath,—each frustule, after passing along in continuous and regular order till it reached the torn orifice of the sheath, being there suddenly and very forcibly expelled to some distance.

I may, in conclusion, add that every effort to render visible the filaments whose existence I assume, either by iodine or reagents, has hitherto failed. In the endosmotic and exosmotic theory of Professor Smith, it became necessary to assume not only as much, but more,—the evidence of currents, which were *essential* to its truth, being deficient. But it is surely unphilosophical to deny the existence of all we are unable to *see*. We may still hit upon some vegetable colouring or dyeing matter, of *innocuous quality to the Diatom*, but capable of staining its most delicate portions. This innocuous character is essential, inasmuch as in any attempt to detect the nature of highly delicate organs, such as the most attenuated ciliary apparatus or

* A novel form of *Coscinodiscus* (provisionally named by me *C. Sol*) is found in the stomach-contents of *Salpæ*. It has a broad membranous plate extending round the periphery of the silicious disk, across which are arranged, radially, very delicate folds *springing from the margin of the silicious portion*. This membranous plate may be looked upon as another modification of the filamentous organs. The occurrence of so very remarkable an appendage to a Diatom affords a valuable confirmation of the view given above.

It may be mentioned that, on exposure to acid, the membranous plate is dissolved, but the silicious disk remains and is then *undistinguishable* from an ordinary *C. radiatus* of small size. Specimens in my possession exhibit the two valves and plates in all their integrity.

motile filaments, our first *glimpse* is generally a passing one, caught during the instantaneous production of a shadow. Or, although our objectives may already be considered almost perfect, that perfection is capable of increase, and we may therefore hope, by a single step in advance, to render the *unseen* of today *the thing seen* of tomorrow.

II.—*Revision of the Family* Pennatulidæ, *with Descriptions of some new Species in the British Museum.* By Dr. John Edward Gray, F.R.S., V.P.Z.S., P.E.S. &c.

[With two Plates.]

Dr. Herklots, the curator of the Royal Museum at Leyden, has lately published in the last Part of the 'Bijdragen tot de Dierkunde,' part vii. 1858, a monograph of this family, describing and figuring several new species. I shall use his work as the basis of this communication, as far as regards the species he describes, which I shall attempt to divide into groups for more easy determination.

Tribe I. Funiculineæ, or *Junciformes*, are elongated Sea-pens with very small pinnules.

A. *The Cells armed with spinules.*

1. Funiculina, Lamk.

* *Axis quadrangular.*

1. *F. quadrangularis*, Johnston, Brit. Zooph. t. 31. Scotland.

** *Axis cylindrical.*

2. *F. Christii*, Sars, Fn. Litt. Norv. ii. t. 12. f. 7–12. Coast of Norway.

3. *F. Finmarchica*, Sars, Fn. Litt. Norv. ii. t. 11. Coast of Finmark.

B. *Cells fleshy, not spinulose.*

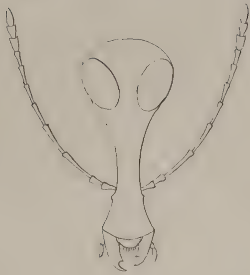
2. Virgularia, Lamk. Axis stony, tapering at each end. Cells not produced.

* *Pinnules well developed, digitate, diverging from the rachis.*

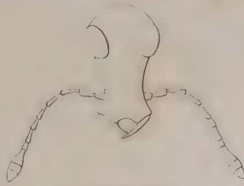
1. *V. Vanbenedensis*, Herklots, Not. 11. t. 7. f. 7. *Hab.* ——.

2. *V. Ellisii*. Elongate. Rachis cylindrical. Base elongate, nearly one-third the entire length; lower part much dilated, club-shaped. The lower pinnules adpressed, far apart, nearly transverse as regards the rachis; the upper ones lunate, far

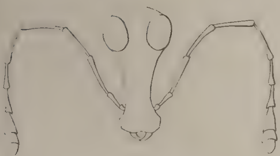
HUCUS



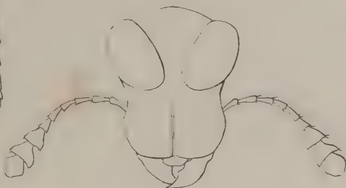
MYCTIS



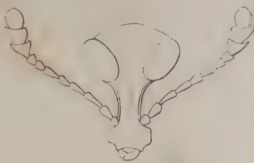
ETHNECA



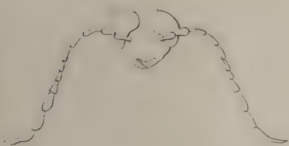
PLINTHERIA



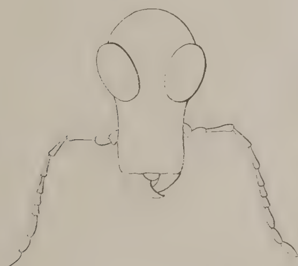
NESSIA



ESOCUS



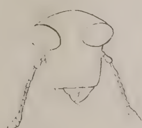
DYSNOS



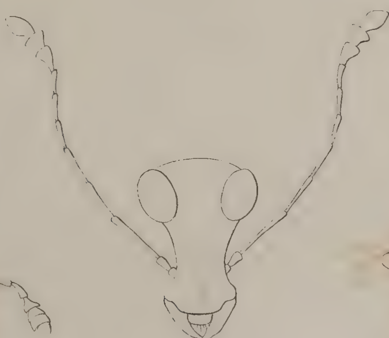
APATENIA

MISTHOSIMA

HYPSEUS



PHAULIMIA

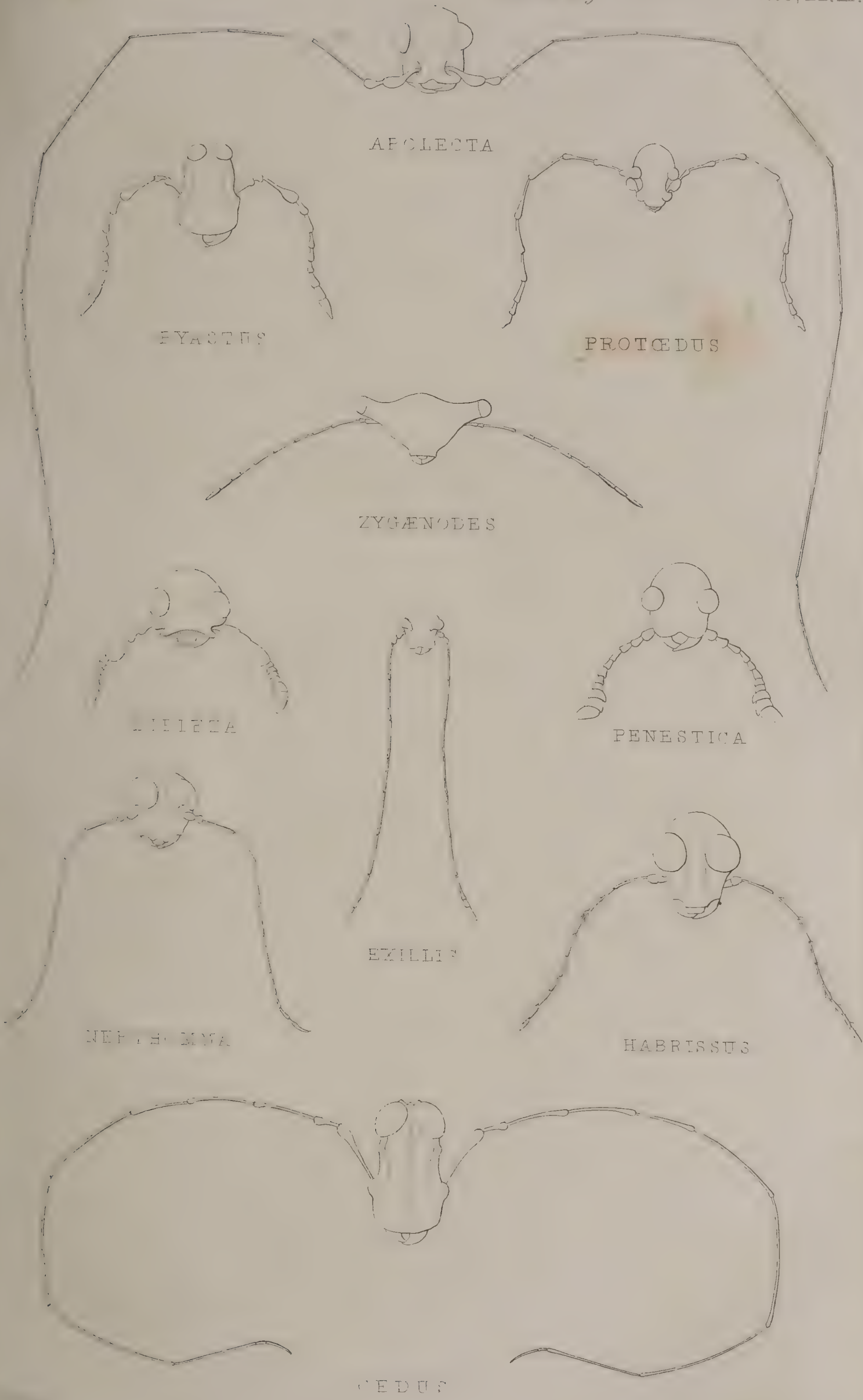


ECZESARIS

PHLEOCHROTES

GENETHI

F.P.P. del.


APOLECTA
PROTŒDUS
ZYGÆNODES
PENESTICA
EXILLIS
HABRISSUS
CEDUS

apart, placed alternately on each side of the axis, with distinct digitate tubercles.

Hab. ——. (Broken; perhaps imperfect.)

***Pinnules all adpressed, nearly transverse to the rachis.*

3. *V. juncea,* Esper, t. 14. Molucca and Borneo.

4. *V. Reinwardtii,* Herklots, Not. 13. t. 7. f. 8. Indian Seas.

3. Lygus, Herklots. Axis filiform, cylindrical, flexible, contracting spirally. Pinnules formed of diverging cells.

1. *L. mirabilis,* Müller, Zool. Dan. t. 11. North Sea; Scotland.

4. Scytalium, Herklots. Axis quadrangular, thin. Rachis quadrangular. Pinnules small, triangular, placed obliquely on each side of the front of the rachis.

1. *S. Sarsii,* Herklots, Not. 14. t. 7. f. 6. North Sea.

Dr. Herklots refers to the *Funiculina cylindrica* of Lamarck with doubt. It has only been described from some stony axis. I think there is little doubt of this being the axis of the coral which I described as *Primnoella Australasiæ,* the axis of which agrees well with Lamarck's description. He also inquires what is the *Pennatula scirpea* of Pallas (Zooph. 372. no. 218)? which is not found in collections.

Tribe II. Pennatuleæ, or *Penniformes,* are Sea-pens with well-developed pinnules, shaped like a feather.

Dr. Herklots divides the Pens with the pinnæ supported by radiated spines into two genera; but I am not able to distinguish the genera *Pteromorpha* and *Pteroeides* by our specimens, though I believe that I have a specimen of the species which he gives as the type of his genus. I believe the character given to *Pteromorpha* (that is, the base of the pinnule being granular) depends on the state of the specimens, the granular coat of the pinnules being very deciduous in specimens which have been preserved in weak spirits. I may be wrong; if I am, then a specimen of *Pteromorpha* has not occurred to me.

I think the genera and species may be best arranged thus:—

5. Pennatula, Linn. Pinnules elongate, angular, thin, membranaceous, strengthened by imbedded spicula. Cells in a single series on the edge. Rachis rough behind.

* *Elongate, ovate, lanceolate; stem slender, ½ the entire length; cells separate.*

1. *P. phosphorea.* Pinnules linear, with isolated cells. Esper, t. 6. Europe; coast of England.

** *Ovate; stem thick, ½ the entire length; cells separate.*

2. *P. pulchella.* Pinnules broad, membranaceous, slightly grooved, with close cells. Herkl. Not. 16. t. 1. f. 2. North Cape; coast of Scotland. British Museum. (Not before noticed as British.)

*** *Broad, oblong; stem ⅓ the entire length; cells crowded.*

3. *P. rubra.* Pinnules membranaceous, elongate; cells short, numerous, twenty or twenty-one, crowded, scarcely divided, in a single series. Bohadsch, t. 8. f. 1–5. Mediterranean; coast of England.

4. *P. borealis.* Pinnules broad, with three marginal series of cells. Sars, Fn. Litt. Norv. 17. t. 2. North Sea.

6. Leioptilus. Pinnules elongate, angular, fleshy, slightly grooved, without any elongated radiating spine. Cells crowded in a double series on the edge of the pinnules. Rachis granular behind.

1. *L. fimbriata*, Herklots, Not. 18. t. 3. f. 3, t. 4. f. 1. Japan.

7. Pteroeides, Herkl. Pinnules elongate, angular, expanded and supported by radiating spines. Rachis smooth.

a. Pinnules elongated, well-developed, broader than rachis.

* *Elongate, lanceolate; stem ⅓ the entire length; the apex naked.*

1. *Pteroeides elegans*, Herklots, Notic. 20. t. 6. f. 2. Indian Ocean.

** *Elongate, lanceolate; stem ½ the entire length.*

2. *P. grandis*; Pen. grandis, *Pallas*; P. argentea, *Ellis*, Zooph. t. 8. f. 1–3. Indian Ocean.

*** *Elongate-oblong; stem ½ or ⅓ the entire length.*

3. *P. oblònga.* Elongate oblong. Pinnules 32 . 32, elongate, rather longer than the breadth of the base, subtrigonal. Stem elongate, half the entire length, tapering at the base. Australasia; Swan River. Brit. Mus.

4. *P. grisea.* Stem one-third the entire length. *Pen. grisea*, Bohadsch, t. 9. f. 1–3; *Pteromorpha crispa*, Herklots, Not. 19. t. 5? *Hab.* ——. Brit. Mus.

**** *Oblong, very broad; stem ½ the entire length.*

5. *P. latipinnarum*, Herkl, Not. 29. t. 4. f. 5. Mediterranean.

6. *P. Jukesii.* Broad, oblong. Pinnules 43 . 43, short, broad, subtrigonal; under ones attached by a narrow base. Stem elongate, one-half the entire length, thick, the upper part much

swollen near the pinnæ. Australia; Port Bowen. J. B. Jukes, Esq. Brit. Mus.

***** *Oblong, broad; stem ⅓ the entire length.*

7. *P. Japonicum*, Herklots, Not. 11. t. 2. f. 1. Japan.

8. *P. spinosum*, Ellis, Phil. Trans. liii. t. 21. f. 6–10; Herkl. Not. 21. t. 3. f. 2. *P. grisea*, Chiaje, Mem. t. 31. f. . Mediterranean.

9. *P. Esperi*, Herklots, Not. 20. *P. grisea*, Esper, t. 1. Island of Sumatra. New Guinea. Brit. Mus.

b. Pinnules very short (not developed?); rachis very thick.

10. *P. Sieboldi*, Herklots, Not. 22. t. 8. f. 1. Japan.

What is *Pennatula grandis*, Ehrenb., with the pinnæ very far apart, not imbricate?

8. Sarcoptilus, Gray. Pinnules fleshy, roundish, closely imbricate. Rachis minutely granular.

* *Pinnules with a thin rounded edge, cells small on the edge and around the upper surface near the edge.* Sarcoptilus. *Stem ⅓ the entire length.*

1. *S. grandis*, Gray, Proc. Zool. Soc. 1848, p. 45. t. . Orange. Pinnules small, granular, with a regular, smooth, rounded edge. Stem short, thick, about one-third the entire length. Australia; Sydney. Dr. Bennett. Brit. Mus.

** *Pinnules with a flattened, rather broad edge, spinulose on the margin; cells large, on the flattened edge surrounded with spicula.* Ptilosarcus. *Stem ½ the entire length.*

2. *S. sinuosus*, Pl. III. fig. 1. Oblong. Pinnules much crowded, crumpled, with the edge slightly spinulose. Stem very thick, swollen, as long as the feathered part. New Guinea. Capt. Sir Edward Belcher. Brit. Mus.

3. *S. Gurneyi*, Pl. III. fig. 2. Orange. Pinnules smooth, very much crowded, closely imbricated, with a rather broad, distinctly spinulose edge. Cells crowded. Stem elongate, thick, half the entire length, much swollen above. California, Monterey. J. H. Gurney, Esq., M.P. Brit. Mus.

Tribe III. Kophobelemnonieæ, or *Claviformes*. Club-shaped, with the polypes in longitudinal rows on the front surface.

9. Kophobelemnon.

1. *K. stelliferum*. Pen. stellifera, *Müller*, Z. D. t. 36. f. 1–3. North Sea.

2. *K. Burgeri*, Herklots, Not. t. 7. f. 5. Japan.

Tribe IV. VERETILLEÆ, or *Veretilloids*. Club-shaped, with the polypes scattered on all sides.

10. LITUARIA, Valenc. Axis rudimentary, nearly navicular.

1. *L. phalloides*, Pallas, Misc. t. 23. f. 5, 9.

11. SARCOBELEMNON, Herklots. Axis slender. Rachis with four tubes.

1. *S. elegans*, Herklots, Not. 25. t. 7. f. 3. Stem 1.

2. *S. Australasiæ*, Pl. IV. fig. 1. Club elongate, rather tapering above. Stem short, about one-sixth the length of the club, longitudinal, wrinkled, subacute. Australia; Port Essington. J. B. Jukes, Esq.

The specimen in the British Museum is rather flattened on one of its sides; but this appears to have arisen from its having been pressed against the sides of the bottle when it was first placed in spirits. The polypes are very unequally developed. On one side near the base they appear to be deficient, but, when more closely examined, they are easily seen to be completely retracted and closed over.

12. CAVERNULARIA, Valenciennes.

1. *C. pusillum*, Philippi, Wiegm. Arch. i. 277. t. 4. f. 6. 10. Mediterranean.

2. *C. Valenciennesii*, Herklots, Notic. 26. t. 7. f. 11. Mediterranean.

13. VERETILLUM, Cuvier.

1. *V. cynomorium*, Pallas, Misc. t. 13. f. 1–4. Mediterranean.

2. *V. luteum*, Quoy and Gaim., Ann. Sci. Nat. x. t. 9 *a*. Atlantic Ocean. Bay of Algesiras.

Tribe V. RENILLEÆ. Frondose, expanded, without any axis.

14. RENILLA, Lamk. Disk smooth above and beneath, without spicula, and continued into the stem. Polypes numerous.

* *Reniform, entire.*

1. *R. reniformis*. Disk entire. Ellis, Phil. Trans. liii. t. 29. f. 6. 10. *R. americana*, Schw. Beob. 23. t. 2. f. 10. Coast of Brazil.

2. *R. violacea*. Disk with a notch in front. Quoy and Gaimard, Voy. de l'Uranie, t. 82. f. 5, 6. Coast of Brazil.

** *Oblong, sinuated and lobed on the sides.*

3. *R. sinuata*, Pl. IV. figs. 2, 3. Disk oblong, elongated, sinuated on each side, divided into more or less distinct lobes. Cells

rather distant. Stem thick, as long as the disk, longitudinally wrinkled. Philippine Islands. H. Cuming, Esq. Brit. Mus.

15. Herklotsia. Disk expanded; upper surface armed with spicula surrounding the edge of the cells; lower moderately striated. The stem inserted in a deep notch on the lower edge, and separated from the disk by a well-defined groove. Polypes few, placed in series.

1. *H. Edwardsii.* Renilla Edwardsii, *Herklots,* Notic. 29. t. 7. f. 2. Coast of Central America. D'Orbigny. Mus. Paris.

Umbellularia Grœnlandica was discovered by "Captain Adrians (of the English Grœnland ship the 'Britannia'), a native of Jutland." Two specimens "were drawn up with the line, as they were sounding the sea, out of a clayish ground, 236 fathoms deep, that is, 1416 feet, in 79 degrees North latitude, about 90 English miles from Greenland." "Each of the two plants was broke into three pieces, which accident, however, did not hinder me from laying it before me according to its compleat form and size."

The captain gave them to M. Dunze of Bremen; and the latter gave one to M. Christlob Mylius, who described and figured it in a pamphlet entitled 'An Account of a new Zoophyte,' 8vo, 1754, and the other to Mr. Collinson, who transferred it to John Ellis, by whom it was described and figured in his work on Corallines. The specimen that belonged to Mylius was given by him to M. Hollmann of Gottingen, according to Pallas's 'Zoophytes,' p. 366. What has become of Ellis's specimen is not known; it has probably been destroyed; and the specimen that was in M. Hollmann's collection in 1766 has not since been referred to.

No other specimens appear to have been discovered, which is very remarkable when we consider the number of ships which visit the Northern seas, and the attention which the Danish, Norwegian, and Swedish naturalists (especially the former) have paid to the natural productions of the coast of Greenland.

All the accounts of the coral in the more modern zoological works have been taken from Ellis's description and figure; there are some details in the previous account of Mylius which have been overlooked; he also gave a history of the discovery and the means by which the coral came into his hands, which is entirely omitted by Ellis.

III.—*On the Burmese genus* Sophina. By W. H. Benson, Esq.

Further contributions of shells from the vicinity of Moulmein have enabled me to present more correct diagnoses of *Sophina forabilis* and *S. Calias* than those published in the 'Annals' for May and June 1859; also to state that the singular rift in the columella is common to all the three species assigned to the genus. *S. forabilis* has been found by Capt. J. C. Haughton at the caves of Damathá. The imperfect specimen first described was from the Tenasserim Valley, and was defective at the most important part of the aperture, as were also those of *S. Calias* first sent by Major R. H. Sankey. Hopes were entertained that the present notes might have been accompanied by some account of the animal of *Sophina*; but unfortunately it has not yet been obtained in a living state.

It appears highly probable that the Mollusk may be allied rather to the bitentaculate, bathrommatous, and inoperculate Western genera *Ceres* and *Proserpina*, than to the acrommatous genus *Helix*; but at present this can be merely a matter for conjecture. Even if this singular form should prove to be really Helicidous in character, its separation from *Helix* will rest on as strong or even stronger grounds than some of the groups which have, by common consent, been accepted as genera; and it may possibly take its place between *Nanina* and *Glandina*.

Sophina, B., gen. nov. (char. emend.).

Testa Heliciformis; columella callosa, declivis, cum margine basali angulum efformans; angulus rimatus, rima in carina umbilicali spirali desinente; callus parietalis tenuis expansiusculus.

Helix (Sect. *Sophina*, B., Ann. Nat. Hist. ser. 3. vol. iii. p. 473).

Sophina Calias, B. (char. emend.).

Testa anguste umbilicata, orbiculato-depressa, solidiuscula, oblique striatula, polita, pallide cornea; spira planata, apice saliente, obtuso, sutura marginata, canaliculata; anfractibus 5 subconvexis, sensim accrescentibus, ultimo ad ambitum rotundato, subtus convexiusculo; apertura lunata, obliqua, peristomate recto, acuto, margine columellari oblique recurvatim descendente, calloso, extus crenulato, cum basali angulum fere rectum, arcte rimatum, efformante, rima extremitatem carinæ umbilicalis, sensim spiraliter intrantis, incidente; umbilici perspectivi pariete intus horizontaliter confertim sulcato.

Diam. major 9, minor $7\frac{1}{2}$, axis 4 mill.

Habitat prope Moulmein, ad cavernas "Farm Caves" dictas.

Syn. *Helix Calias*, Benson, Ann. Nat. Hist. ser. 3. vol. iii. p. 473.

Sophina forabilis, B. (char. emend.).

Testa subanguste et profunde umbilicata, conoideo-semiglobosa, tenui, oblique striatula, spiraliter confertissime striata, cornea; spira depresso-conoidea, apice elevatiusculo, obtuso, sutura impressa; anfractibus 6 convexiusculis, ultimo non descendente, ad ambitum rotundato, circa umbilicum perspectivum intus spiraliter striatum carinato, carina spirali, intrante; apertura obliqua, rotundato-lunata, peristomate recto, acuto, margine columellari oblique recurvatim descendente, crassiusculo, subcrenulato, cum basali angulum fere rectum, arcte rimatum, efformante, rima extremitatem carinæ umbilicalis incidente.

Diam. major 6–8, minor $5\frac{1}{2}$–7, axis 3–4 mill.

Habitat ad Phai-Thán vallis Tenasserim, et ad Cavernam Damathá prope Moulmein.

Syn. *Helix forabilis*, Benson, Ann. Nat. Hist. ser. 3. vol. iii. p. 389. Sect. *Sophina*, p. 473.

The three species already known inhabit the vicinity of Moulmein; only one of them has also been found elsewhere. The third and largest (*S. schistostelis*, B.) was sufficiently described, in the paper last quoted, as a *Helix* of the section now treated as a distinct genus. It appears to be scarcely within the bounds of probability that a form so peculiar should be confined to the limited tract in which it has hitherto been collected. Species may have been overlooked, or regarded by persons unacquainted with the subject as merely broken shells, both in the Malay peninsula and in Siam,—possibly even in Cochin China. Other unusual Tenasserim types have occurred in the two countries last named.

Cheltenham, Dec. 3, 1859.

Note.—I have employed the terms "bathrommatous" and "acrommatous" as expressive of certain characters in the animals of shells, and saving recourse to unnecessary details, thereby filling a void in conchological nomenclature. The former word has reference to genera in which the eyes are situated at the base of the tentacula, the latter to those in which they are placed at the summit.

IV.—*On the* Lepton sulcatulum *of* Mr. Gwyn Jeffreys. By William Clark, Esq.

To the Editors of the Annals of Natural History.

Gentlemen, Bath, 21st November, 1859.

It is very desirable to correct the errors of science without delay; I therefore venture to request the insertion of a short paper in your excellent Journal.

In the 'Annals of Natural History,' 3rd series, vol. iii. p. 406, I submitted some observations on Mr. Jeffreys's "Gleanings in British Conchology," in one of which (in the series, and page 34 of the vol. above quoted) that gentleman has introduced a new species termed *Lepton sulcatulum*, illustrated by Pl. II. fig. 2 *a–g*, and on which, in the same vol., p. 409, I have stated amongst my remarks, that "*Lepton sulcatulum* appears to be a good species—that is, on shell examination."

This conjecture has not been verified, as I think I shall prove that no such species exists; my opinion was based on the examination, as I thought, of a perfect shell. I was misled by the specimens sent me by Mr. Jeffreys, which proved imperfect in having a portion of the primary denticular processes broken away; and in consequence the point within the beaks appeared to present a fovea or pit indicative of an internal ligament, and the shell had thus an approach to the hinge of a *Lepton*. I received only one entire example, which could not be safely opened, and four separate valves. The matter has rested here for some months; but having been, only last week, very unexpectedly favoured by the Rev. Alfred Norman with perfect closed and open examples of the *Lepton sulcatulum* of Jeffreys from Jersey or Guernsey, and also having had, within these few days, the whole of Mr. Norman's stock of that supposed species forwarded to Bath for my inspection, I am enabled to say, aided by two fine live specimens which I fortunately have just discovered in my cabinet, that they do not represent a new species of *Lepton*.

These minute objects are the fry of the well-known *Circe minima*. I have rigorously compared them with many sizes of that species. Four excellent open pairs of these very young shells show the precise dentition of *Circe*; the ligament, as in it, is short, linear, and essentially external, though it is in a great measure obscured from view by running within the commissure of the two valves; the pallial impression, as in that species, is almost without a posterior sinus (indeed it is scarcely indented), and proves that the tubes of the animal are short, and that it is closely allied to *Cyprina* and *Astarte*; the cordiform impression under the beaks even of these Circæan pigmies is very visible in fresh examples, but in the worn and imperfect shells usually seen in collections it is hardly discoverable; in adults it is not very strongly marked.

If the dentition of these minute phases of *Circe* is placed under the microscope, in comparison with the accredited Leptons (of which we have only three species), the discrepancy of the two will be apparent. The former (*Circe*), under adequate optical assistance, which should not be less than the half-inch object-

glass of the compound microscope, presents in the right valve three divergent cardinal teeth, with well-developed laterals on the anterior side, and others more elongated and obsolete posteriorly; in the left valve there are also three cardinals, with, on the anterior side, a strong lateral, and another very inconspicuous one at the posterior end. The latter (*Lepton*) in both valves, shows *only* a single, rather slender, conical, pointed primary tooth projecting subhorizontally inwards, or at an angle of from 60°–90°; and the laterals in the right valve on each side are double, with a single lamina on each side in the left valve.

Mr. Jeffreys's scheme of dentition is greatly at variance with the preceding; but the error of that gentleman may have arisen in consequence of his having only dead, worn, and imperfect specimens, in which the laminar portion of the dentition is often wanting. If a pair of valves of the adult *Circe*, and another of these young objects, are placed in a parallel position as regards the dentition, it will be seen that in both it is identical. I have found this to be the case in every perfect shell of Mr. Norman's that I have examined.

The character of the beaks being caliculated is a very unimportant one, as many bivalves in extreme youth are so, but the calix, as the shell grows, wears away; and even in my live example, of only $\frac{1}{20}$ of an inch diameter, the commencement of the sloughing-off is seen; and it is not till then that the germ of the external ligament is visible, and the true beaks, with their slight anterior arcuation, become established.

It thus appears that there is not a congruous character in *Lepton* and *Circe*; they differ in contour, sculpture, dentition, ligament—in fact, in nearly all points. I therefore think the argument has sufficiently proved that the so-called *Lepton sulcatulum* is not a new species, and that it is one of the young conditions of the *Circe minima*.

I am, Gentlemen,

Your most obedient Servant,

Wm. Clark.

V.—*On the Development of* Pyrosoma. By Thomas H. Huxley, F.R.S., F.L.S., Professor of Natural History, Government School of Mines.

The following abstract contains an account of some observations which were laid before the Linnæan Society at its meeting of the 1st of December 1859.

A fine specimen of *Pyrosoma giganteum* having come into my hands through the kindness of Admiral Fitzroy, of the Marine Department of the Board of Trade, I sought in it for those sin-

gular compound embryos described by Savigny, but which I had been unable to find in the specimen which formed the subject of my memoir on *Pyrosoma** published in the 'Philosophical Transactions,' nearly nine years ago. Such embryos proved to be exceedingly abundant; and as might have been expected from Savigny's known accuracy, his account of their structure turned out to be perfectly correct, so far as it goes. The excellent state of the specimen, however, led me to endeavour to trace out the origin and mode of development of these bodies; and in so doing I came upon facts of such an anomalous character, that the inquiry assumed much larger proportions, and became invested with a far wider interest, than I had anticipated.

I must premise that the tissues of *Pyrosoma*, as of all Ascidians, are excellently preserved by immersion in tolerably strong spirit—so that the finest details, down even to the ends of the cilia, are admirably exhibited; while the cautious addition of glycerine to sections of spirit-specimens renders them more transparent, without, so far as I have perceived, doing them any injury.

I will now proceed to describe the process of development undergone by the impregnated ova.

As I have pointed out in the memoir referred to above, each zooid of a *Pyrosoma* contains a large testis, and a single ovum enclosed within an ovisac but little larger than itself. Until the ovisac attains a diameter of $\frac{1}{250}$th of an inch, or thereabouts, the duct which connects the ovisac with the wall of the atrium, or cloacal cavity of the zooid, is imperforate at its extremity, and its walls, like those of the ovisac, are composed of a single layer of cells without any limitary membrane or tunica propria. There are no cilia either on the wall of the ovisac or on that of the duct. The ovum consists of a large, spherical, clear germinal vesicle, containing a spherical, more or less solid-looking germinal spot, and surrounded by a yellowish, very finely granular yelk, which is totally devoid of any vitelline membrane. The germinal vesicle lies on one side of the yelk, and the spot on the same side of the vesicle.

In ovisacs of larger size (up to $\frac{1}{100}$th of an inch in diameter) the duct is pervious throughout; and, as it is open at its extremity, it is in free communication with the atrium, and, through that, with the exterior. The ovum still fills the ovisac, its yelk being in the same condition as before, but larger, both absolutely and in relation to the germinal vesicle. The latter has also enlarged up to a diameter of about $\frac{1}{470}$th of an inch, but it is

* Observations on the Anatomy and Physiology of *Salpa* and *Pyrosoma*, 'Philosophical Transactions,' 1851, p. 2.

still perfectly clear and transparent. The spot retains its previous form and dimensions.

In these ovisacs I have been always able to find spermatozoa either entering the mouth of the duct or, more usually, aggregated together into a sort of conical bundle or plug, at the wide end of the duct, where it opens into the ovisac. Not unfrequently the broad end of this plug was in direct contact with the yelk itself. I have assured myself of these facts by observing the contents of the ovisac when opened with a fine needle, or, more accidentally, by making thin sections with a razor; and I have satisfied myself that the bundle of filaments in question (itself very obvious) consists of spermatozoa, by comparing them with the contents of the deferent duct of the testis of *Pyrosoma**.

The spermatozoa must always come from some other zooid (if not from another individual), inasmuch as the testis of zooids containing ovisacs in this state is in a very rudimentary condition. At no period, either before or after impregnation, can any vitelline membrane be discovered; but what surprised me most was, that in ovisacs of larger size than $\frac{1}{100}$th of an inch in diameter the yelk itself was absent, at least in its previous form. Not a trace of it is to be seen; and I can only imagine that it is completely liquefied and dissolved in the clear fluid which forms the sole contents of the ovisac besides the germinal vesicle. The latter is naked, and attached to the epithelial lining of the wall of the ovisac (which is now differentiated into epithelium and tunica propria) close to the opening of the duct into it, and, so far as I have observed, always a little behind and to one side of that opening. This constancy in the position of the germinal vesicle becomes very important as a means of identifying the germinal vesicle in subsequent stages of development. Neither in this nor in any subsequent stage does the germinal vesicle attain a mean diameter of more than $\frac{1}{400}$th of an inch, while ova in an earlier stage, surrounded by their yelks, often measure $\frac{1}{190}$th of an inch, or fully double the size. Besides this, the germinal vesicle is at first perfectly transparent and clear, and the germinal spot, which retains its primitive size and appearance, is recognizable in it with the utmost ease. It is quite impossible, therefore, to confound the germinal vesicle with the ovum of earlier stages, or the germinal spot with the germinal vesicle of previous stages.

That no solid yelk, such as previously existed, now invests the germinal vesicle, is rendered obvious by opening the ovisac and everting that part of its wall to which the germinal vesicle is

* In my memoir on *Pyrosoma* (*l. c.* p. 584) I have described appearances which led me to believe I saw moving spermatozoa in the duct in living specimens.

attached. The sharp contour of the membrane of the germinal vesicle is then easily seen to be covered by nothing but a very thin continuation of the pale delicate epithelium of the ovisac which invests it and holds it in place, just as the discus proligerus holds the human ovum in its place in the Graafian follicle.

In the earlier stages, I have turned the ovum out of the ovisac with its yelk quite entire; so that there can be no question here of destruction by manipulation.

As the ovisac enlarges (up to $\frac{1}{40}$th of an inch), the germinal vesicle and spot retain their previous size; but the contents of the vesicle, instead of remaining transparent, become thick and troubled, and acquire a yellowish colour and a certain opacity, so as very nearly to resemble the previous yelk in consistence. I have observed that this deposit appears to commence on that side of the germinal vesicle which is turned towards the duct, in consequence of which, the membrane of the vesicle is apt to become shrunken and corrugated on the opposite side; so that, viewed under a low power, it may appear truncated on that side. Ultimately the whole vesicle is converted into a solid-looking flattened mass, in which the germinal spot is perfectly distinguishable, while the membrane of the vesicle is hardly visible as a distinct structure. The altered vesicle is now invested on its inner side by the epithelium, while externally it is in contact with the membrana propria of the ovisac.

There is now a slight gap (which I hope yet to be able to fill up satisfactorily) in my observations. Ovisacs of $\frac{1}{30}$th of an inch in diameter no longer show the solidified germinal vesicle; but occupying exactly the same place is a thin discoidal oblong body, about as wide as the solidified germinal vesicle, and of the same colour, but between two and three times as long. In this, no trace of the germinal spot is visible; but it is composed of minute celliform bodies, with distinct endoplasts or nuclei, of the same aspect as the germinal spot, though much smaller. The celliform bodies are above $\frac{1}{1800}$th of an inch in diameter, the endoplasts $\frac{1}{9000}-\frac{1}{10000}$th, while the germinal spot attains its full diameter of about $\frac{1}{2000}$th of an inch in very young ova, and neither increases nor diminishes in older ones.

This is the earliest rudiment I have discovered of the blastoderm. The ducts of ovisacs of this size have a shrunken, withered look; and if there are spermatozoa in them, they are few and not aggregated into a plug or bundle: on the other hand, scattered about over the surface and on the face of the blastoderm, I observe a number of minute rod-like solid bodies, curiously similar to the heads of the spermatozoa.

Simultaneously with, or slightly anterior to, the formation of the

blastoderm is a very remarkable change in the epithelium of the ovisac, which becomes converted into a thick transparent substance containing many spheroidal excavations, which are, apparently, the cavities of the primitive epithelial cells.

I have little doubt that the germinal spot divides and subdivides, and that each of its portions appropriates to itself a segment of the semisolid contents of the germinal vesicle, to form the endoplast and its investment or one of the constituents of the blastoderm. At present, however, I have no absolute proof that such is the case, though I have seen a germinal vesicle with four or five granules of unequal size in the place of the germinal spot.

The blastoderm rapidly enlarges, and forms an oblong patch, which extends over a gradually increasing segment of the circumference of the ovisac, between the membrana propria (which gradually disappears over it as a distinct structure) and the epithelium, and at the same time becomes covered with a thickish layer of transparent substance, the rudiment of the future cellulose test of the *Pyrosoma*.

The elongated band-like blastoderm next becomes marked out, by four constrictions, into five portions. That segment which terminates one end of the series enlarges faster than the others, and invests one end of the ovisac with a sort of cap; the other four portions assume a heart-shape, the base of each 'heart' being turned towards the 'cap.' All five portions remain connected by narrow necks. In this stage the blastoderm extends over one half of the circumference of the ovisac, which is about $\frac{1}{30}$th of an inch in diameter.

Up to this point the ovisac has remained within a chamber of the sinus-system of the parent zooid, by whose blood it is bathed on all sides; but it has gradually thrust the atrial wall of that chamber before it, and eventually it breaks through the wall, and passes into the atrial cavity, a very large portion of which it occupies. The duct of the ovisac (now a mere thin cord as compared with the whole ovisac) is broken through in the course of this curious natural Cæsarian parturition, and soon ceases to be discoverable.

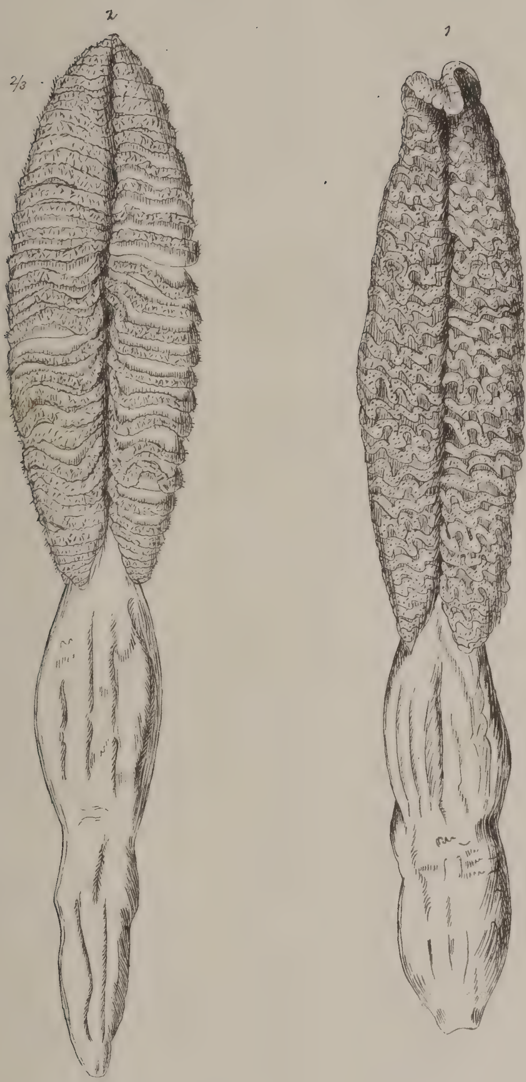
The young blastoderm itself is, as I have said, almost directly bathed by the parental blood so long as the ovisac remains in the sinus, while the thin walls of the ovisac must allow of such an abundant passage of nutritive matter into its interior that it must serve as a great reservoir of material for the developing embryo after birth. The contents of the ovisac, therefore, though neither a food-yelk nor a placenta, serve the purpose of both.

It would be impossible, without the figures with which I propose to illustrate the memoir presented to the Linnean Society,

to explain in detail the further steps of the metamorphosis of the young *Pyrosoma*, the structure of the adult, or the agamogenetic development of young zooids in it; but I may mention that the 'cap' is the rudiment of the cloaca, a structure at first totally distinct from the four *Ascidiites* (as the members of compound Ascidians might be termed, in harmony with *Polypite, Somite*, &c.), and homologically equivalent to one of them. The four Ascidiites, connected by their gradually-lengthening intermediate necks of blastoderm, change their positions so as to become, as it were, wound half round the base of the rudiment of the cloaca, with which they become gradually united, without at first in any way opening into it. Enlarging faster than the rudiment of the cloaca, they next completely encircle it, and so extend, on each side, beyond it and the ovisac which it caps, as almost to hide both these structures. The different organs make their appearance, and the embryo attains a size of $\frac{1}{16}$th of an inch, or thereabouts. I have met with no embryo larger than this, and I doubt if such are to be found contained in the parent organism, as they fill the cloacal chamber of the atrium so completely that there seems to be no room for any further enlargement. Indeed, it is difficult to understand how they get out, so disproportioned are they to the diameter of the cloacal aperture of the zooid.

The largest embryos exhibit neither rudimentary buds nor reproductive organs, and each has two short canals passing from the inner or hinder end of its neural surface towards the aperture of the general cloaca. The latter lies altogether above the primitive rudiment of the cloaca; and into it the cloacal apertures of the four Ascidiites open. The primitive neck-like portion of blastoderm connecting the zooid nearest the rudiment of the cloaca with it is now converted into a long canal, which debouches just in front of the ganglion, while from the opposite side and end of the zooid, close to the end of the endostyle, a similar slender tube passes to the region in front of the ganglion in the next zooid. The other zooids are connected in the same way; so that the four Ascidiites and the rudimentary cloaca are tied together head and tail, like horses going to a fair,—the 'tail' of the last zooid, as of the last horse, being unfettered.

By the observations of Müller on *Entoconcha* and of Gegenbaur on *Sagitta*, the question as to the fate of the germinal vesicle after impregnation, or, rather, after yelk-division, has been reopened; and the observations I have detailed tend to show that in *Pyrosoma*, as in *Entoconcha* and *Sagitta*, the embryo-cells are the lineal descendants of the germinal vesicle, and that the doctrine of Remak and Virchow is applicable to the early stages of development.



1. Sarcoptilus sinuosus. 2. S. Gurneyi

W. West imp

1. Sarcobelemnon Australasiæ. 2. 3. Renilla sinuata.

W West imp.

The nearest analogy I am aware of for what occurs in *Pyrosoma* is the process of development of the embryo observed by Kölliker in *Ascaris dentata* and in *Cucullanus elegans*, where the yelk is a nearly clear fluid, which undergoes no segmentation, but merely serves to suspend the embryo-cells. These embryo-cells are, however, according to Kölliker, new products arising totally independently of the germinal vesicle; so that, if this be the case, there is a fundamental difference between the two processes—quite apart from the fact that, in the worms, there is a vitelline membrane, and that the representative of the ovisac plays no such part as in *Pyrosoma*. Indeed, in this respect the development of *Pyrosoma* appears to be unique, as our present knowledge stands; though I strongly suspect that the development of *Salpa* will some day be found to be very similar. No one of the many observers of the *Salpæ* (Krohn, Vogt, myself, Leuckart) have seen yelk-division in these animals; and the passage of the embryo into the atrium appears to be effected in them in essentially the same manner as in *Pyrosoma*.

On the other hand, although there is not an exact identity, it must be admitted that there is a very close analogy between the changes undergone by the ovisac of *Pyrosoma* and that through which the ovum of a bird passes, if we consider the vitelline membrane (*i. e.* what is ordinarily regarded as such) of the bird's egg to represent the tunica propria of the ovisac of *Pyrosoma*.

VI.—*On some new Anthribidæ.*

By Francis P. Pascoe, F.L.S. &c.

[With two Plates.]

[Concluded from vol. iv. p. 439.]

Xenocerus equestris.

X. niger; capite prothoraceque albo-lineatis; elytris sutura (apice excepto), fascia postica, vittaque basali albo-tomentosis.

Hab. Aru.

Elongate, tomentose, dull black; a white stripe, commencing at the apex of the rostrum on each side, divides beneath the eye, one branch, proceeding over its upper margin, is continued along the lateral border of the prothorax to the elytron, where, gradually tapering to a point, it terminates at rather more than half its length, the inferior branch, passing beneath the eye (which has thus a nearly complete border of white encircling it), joins the great mass of pure flake-white, which occupies the whole of the under surface except the pro- and mesosterna; another stripe, commencing between the eyes, passes along the centre of the prothorax, the scutellum, and suture, to near the declivity at

the apex of the elytra, where it divides and passes directly across to the external margin on each side; antennæ of the male between three and four times the length of the body, black; legs black, with a sparse whitish pubescence; tarsi ashy, the penultimate joint entirely, and the apices only of the others black. Allied to *X. saperdoides*, Germ. Length 7 lines.

Xenocerus deletus.

X. piceus, cervino-tomentosus; capite prothoraceque obscure albido-trivittatis; elytris linea curvata basali fasciaque pone medium albidis.

Hab. Borneo.

Pitchy, with a short reddish-grey pubescence; from the apex of the rostrum on each side a greyish-white line passes to the eye, and along its upper margin to the vertex, where it shades away to a short central line in front; prothorax with three greyish-white stripes; elytra finely punctato-striate, the base of each with a strongly curved line from the shoulders to the suture, and a fascia behind the middle, the anterior portion of which curves upwards on the suture, greyish-white; antennæ in the male two or three times the length of the body, black, with the fourth and fifth joints ashy at the base; legs black; first, second, and fourth tarsal joints ashy at the base; under surface greyish white; pro- and mesosterna black. Length 6 lines.

Xenocerus fimbriatus.

X. niger, parce griseo-pubescens; prothoracis disco nitido; antennarum articulo secundo apice fimbriato.

Hab. Borneo.

Elongate, black; crown of the head and disk of the prothorax smooth, shining; sides of the latter, rostrum, and line over the eyes, with a thin greyish pubescence; elytra strongly punctured in rather coarse rows, and covered with a sparse, greyish or somewhat fulvous pubescence, with a few obscure spots of lighter colour; antennæ of the male about twice the length of the body, black, the second joint fringed with crisp curved hairs at the apex; legs black, base of the last tarsal joint ashy; beneath black, the abdomen with greyish hairs. Length 7 lines.

Xenocerus variabilis.

X. angustior, luteus, cervino-tomentosus; prothorace nigro quadrivittato; elytris nigro-subtessellatis; antennarum articulo quinto apice fimbriato.

Hab. Borneo.

Rather narrow, yellowish brown, with a short reddish-grey tomentum varied with ashy; disk of the prothorax clouded with

ashy, on each side two black stripes; elytra finely punctato-striate, spotted with black, the spots nearest the scutellum, and again near the apex, more or less connected, the third and seventh interstices ashy; antennæ compressed, half as long again as the body, black, the fifth joint fringed with short crisp hairs at its apex beneath, the eighth white, except on one side; legs reddish grey; tarsi black, varied with ashy; beneath with a coarse yellowish-grey tomentum. Length 5 lines.

A variable species in regard to colour, the stripes on the prothorax being sometimes represented by spots, or the spots on the elytra nearly altogether unconnected. The antennæ also vary considerably in length.

Cedus.

Head narrowed in front; the rostrum large, flat, suddenly expanded below, the apex entire. Antennæ three or four times the length of the body, arising from an irregular cavity directly over the expansion of the rostrum; the first joint long, swollen at the apex; the second much shorter; the third as long as the first; the remainder to the eighth gradually increasing in length; the last three shorter, not forming a club. Eyes approximate, large, round, entire, occupying the upper part of the head. Labrum very small. Mandibles short. Palpi slender, pointed. Prothorax short, very transverse, subdepressed, the carina somewhat distant from the base, strongly curved and slightly hooked at the sides. Scutellum small, subquadrate. Elytra short, widest at the base. Legs of moderate length; the first tarsal joint elongate. Mesosternum short, very transverse.

Cedus tuberculatus.

C. ovatus, nigro-tomentosus; elytris purpurascenti-nigro-variis, singulis basi tuberculatis.

Hab. Singapore.

Ovate, covered with a dense black tomentum; head between the eyes slightly grooved; rostrum finely granulated, with a central costa descending to the apex, and two short lateral ones below the eye; prothorax irregular, with a few small reddish-orange spots; scutellum reddish orange; elytra very short, brownish black, varied with dull purplish brown, a reddish-orange spot at the side and a large elevated tubercle at the base of each near the scutellum; antennæ reddish brown, the apical half of the eighth joint and the whole of the ninth, except at the apex, white; legs black, the anterior and posterior tibiæ and tarsi varied with pale red; beneath black, with a thin silvery pubescence. Length $3\frac{1}{2}$ lines.

Cedus tuberculatus is a MS. name of Mr. Waterhouse's, by which this species has been long known in collections.

Cedus guttatus.

C. subovatus, anthracinus, tenuiter pubescens; rostro albo; prothorace elytrisque cinereo-guttatis.

Hab. Borneo.

Subovate, bluish black, smooth, finely pubescent; head with a central striga commencing on the vertex, but not descending to the apex of the rostrum, with two short lateral ones below the eye; the rostrum in front covered with a dense white pubescence; prothorax with a semicircular groove on its disk, and several distinct ashy specks; elytra subdepressed, smooth, gradually narrower towards the apex, with numerous ashy spots; antennæ entirely black, except the last joint, which is white; legs black varied with ashy; beneath with a dense silvery-white pubescence. Length 4 lines.

BYASTUS.

Head large, gradually dilating below the eyes; the rostrum very broad and long, a little concave in front, suddenly expanded at the side near the middle; the apex entire. Antennæ shorter than the body, arising from a punctiform cavity in the angle formed by the expansion of the rostrum; the first joint much longer than the second, the third longest, their apices tumid, the remainder short and incrassate, the last three forming a narrow, fusiform club. Eyes subapproximate, round, entire, occupying the upper part of the head. Mandibles short, stout. Labrum small, narrow. Palpi slender. Prothorax transverse, a little narrower anteriorly, the carina somewhat distant from the base, strongly curved at the flexure. Elytra subdepressed, slightly rounded at the sides. Legs of moderate length; first tarsal joint elongate.

Byastus cephalotes.

B. ovatus, nigro-tomentosus; fascia obliqua suboculari elytrisque maculis ochraceis ornatis; antennis pedibusque ferrugineo-annulatis.

Hab. Borneo.

Ovate, covered with a dense black tomentum; rostrum thinly pubescent, with a central straight and three curved strigæ on each side, and a short, oblique ochraceous band beneath the eye; prothorax with two or three obscure ochraceous spots at the base; elytra obscurely punctato-striate, with a large basal subtriangular patch and a few round spots ochraceous; the striæ, principally near the base and at the sides, faintly speckled with

the same colour; femora and body beneath black; tibiæ, tarsi, and antennæ varied with brownish red. Length 2 lines. British Museum.

PROTÆDUS.

Head small, broad and rounded in front, slightly narrowed below the eyes; rostrum very short, concave anteriorly, and contracted at the apex. Antennæ much longer than the body, arising from a large round cavity immediately beneath and a little in front of the eye; the first joint large and inflated, the second short; the club of three narrow, interrupted joints. Eyes small, remote, round, entire. Mandibles short. Labrum rather large. Palpi slender. Prothorax convex, rounded anteriorly, as wide as the elytra at the base; the carina basal, forming a sharp angle at its flexure, and continued to the anterior border of the prothorax. Elytra convex, slightly gibbous at the base. Legs of moderate length; first tarsal joint elongate.

Protædus mœrens.

P. elongato-ovalis, nigro-tomentosus; capite antice prothoracisque lateribus albis; elytris albo-guttatis.

Hab. Batchian (Moluccas).

Elongate-oval, covered with a dull black tomentum; head between the eyes, a narrow stripe above the eyes, rostrum and sides of the prothorax white; elytra punctato-striate, the alternate interstices spotted with white, the base with a slight tinge of greyish; antennæ and legs ferruginous brown; pygidium with a sparse white pubescence; mandibles, eyes, and body beneath black. Length 2 lines.

The male has the antennæ longer than the female, and all the joints from the fifth or sixth are nearly or quite as thick as the club itself; in the female the funiculus is of the normal slender form, except that the basal joint preserves the same character as in the male, but is a trifle narrower. It is to allow full scope to the movement of this joint that the anterior margin of the antennal groove is so expanded as to cause the concavity in front of the rostrum described in the generic character.

HYPSEUS.

Head broad in front, contracted below the eyes; rostrum very short, convex, rounded below, the apex entire. Antennæ short, arising from a deep groove below the eye, the first two joints tumid, the last three ovate, forming a broad flat interrupted club. Eyes remote, prominent, obliquely oblong, entire. Labrum transverse. Palpi rather stout. Prothorax subquadrate, a little narrowed in front; the carina distant from the base,

arching forwards, dividing at the side into two diverging branches, the posterior terminating at the prothoracic angle, the anterior continued to about two-thirds the length of the prothorax. Scutellum small, round. Elytra subconvex, parallel. Legs of moderate length; the first tarsal joint shorter than the rest together.

Hypseus fascicularis.

H. elongato-ovalis, piceus, vario-fusco-tomentosus; elytris fasciculatis, pone medium in singulis macula griseo-alba ornatis.

Hab. Borneo.

Elongate-oval, pitchy, tomentose; general colour dark brown, obscurely varied with lighter shades of the same colour; on the prothorax a dark crescent-shaped mark, interrupted in the middle, and two others behind; elytra obscurely punctato-striate, four dark fascicles of hairs placed longitudinally on each, the first at the base on a slight callosity, behind the middle fascicle an oblique dull-whitish spot; when viewed with the head towards the observer, each alternate interstice at the base is found to be obscurely spotted with white, and the other interstices have a slight tinge of yellowish brown; antennæ brown, the two basal joints testaceous red; legs dark brown, varied with ferruginous. Length 2 lines.

Ethneca.

Head small, rather narrow; rostrum moderately long, slightly contracted in the middle, dilated below; the apex subemarginate. Antennæ short, arising from a shallow groove near the apex; the first two joints subequal, tumid; the third longest; the last three forming a short compact club. Eyes lateral, round, entire. Labrum subquadrate. Maxillary palpi rather robust, subacuminate; the labial slender. Prothorax subconic, convex; the carina rather distant from the base, but approaching the posterior angle at the side, and terminating in a slight curve. Scutellum subquadrate. Elytra short, wider than the prothorax, its sides rounded. Legs rather short, stout; the first tarsal joint wider than the rest, and produced at the apex on each side. Mesosternum rounded posteriorly.

Ethneca Bakewellii.

E. ovata, picea, nigro-tomentosa, fulvo-maculata; rostro medio longitudinaliter impresso.

Hab. Australia (Melbourne).

Ovate, pitchy, with a brownish-black tomentum and greyish-yellow hairs thinly interspersed; rostrum with a broad shallow longitudinal impression in the middle; scutellum fulvous; ely-

tra strongly punctato-striate, the alternate interstices tessellated with deep black and fulvous; antennæ fulvous, apices of the joints and club dark brown; legs dark brown, the tibiæ and tarsi varied with greyish; beneath pitchy black, with a very slight greyish pile. Length 3 lines,

Named after Robert Bakewell, Esq., of St. John's Wood, the possessor of a large collection of Australian insects, who first (and I believe it was the only time) took several individuals of this species near Melbourne. I am also indebted to him for the opportunity of describing the next very remarkable genus. There are two more Anthribidæ in his collection, one related to *Tropideres,* the other an *Aræcerus* (perhaps *A. sambucinus,* M'Leay), both from Melbourne; but as they are single specimens, and very small and obscure, I hesitate to describe them at present as new. These bring up the number of Australian species* known to me to about ten. Although many more doubtless remain to be discovered, the poverty of this family in Australia is strongly contrasted with its abundance in the Indian islands: even the neighbouring land of New Guinea yielded forty-five species to Mr. Wallace during his short visit, notwithstanding that his researches were confined to the very narrowest limits, not ranging over, I believe, more than a square mile of the country around the half settlement of Dorey.

GENETHILA.

Head rather broad in front, slightly contracted below the eyes; the rostrum stout, the sides nearly parallel, the apex deeply emarginate. Antennæ short, arising from a deep groove at the side near the apex; the first joint short, almost hidden in the groove; the second tumid, and longer than the third; the last three forming a stout compact club. Eyes distant, lateral, nearly round, entire. Labrum descending to the outer margin of the mandibles when closed. Maxillary palpi rather stout, the terminal joint conical; the labial slender, pointed. Prothorax elongate, arched above, narrowed anteriorly, the sides slightly rounded, the carina basal, terminating in a slight hook at the side. Scutellum ovate. Elytra wider than the prothorax, elongate, subparallel, truncate at the apex. Legs of moderate length; coxæ of the middle pair subapproximate; the four anterior tarsi longer than the posterior, the first joint nearly as long as the rest together.

In habit and coloration very similar to *Ancylotropis,* Jekel, but differs in the short antennæ, the stout club, the thick broad

* Tasmania is excluded. *Anthribus griseus,* Fab., and *Cratoparis ceratoderes,* Sch., are too doubtful to be included among Australian insects.

rostrum, &c. A second species of *Ancylotropis* is found at Amboyna.

Genethila retusa.

G. oblonga, picea, griseo-tomentosa; scutello maculaque laterali elytrorum albescentibus.

Hab. Moreton Bay.

Oblong, pitchy, with a thin greyish tomentum; rostrum with a depressed longitudinal line in the centre; prothorax with two oblique impressed lines, forming a V-shaped mark on its disc; elytra punctato-striate, wider than the prothorax at its base, slightly dilated towards the apex, then suddenly and perpendicularly truncate, the truncated portion of each with two tubercles clothed with fulvous hairs; near the shoulder on each side, but extending behind the middle, an obscure whitish subtriangular patch, and at the base two rows of small blackish spots; antennæ and legs dull yellowish brown; eyes black; head and thorax beneath pitchy, punctured. Length 3 lines.

PHÆOCHROTES.

Head broad in front, contracted below the eyes; rostrum of moderate length, slightly dilated towards the apex, which is entire. Antennæ shorter than the body, arising from a longitudinal cavity above the apex; the first two joints short, scarcely thicker than the third, the rest gradually dilating at their apices to the eighth, which is broadly triangular; the last three forming a stout, ovate, compact club. Eyes large, remote, lateral, round, entire. Mandibles rather long. Labrum small, rounded below. Palpi slender, acuminate. Prothorax slightly depressed, narrowed anteriorly, the carina subbasal, strongly curved at the side. Elytra short, subdepressed, covering the pygidium. Legs of moderate length; first tarsal joint elongate.

Phæochrotes porcellus.

P. subovatus, piceus, parce griseo-tomentosus, obsolete fusco-maculatus.

Hab. Macassar.

Subovate, slightly depressed, pitchy brown, sparingly covered with a short, coarse, greyish tomentum, varied on the head and prothorax with a few indistinct brownish patches; elytra punctato-striate; antennæ at the base ferruginous, darker at the apices of the joints, the last four or five entirely brown; body beneath and legs dark brown, bases of the tibiæ reddish ferruginous. Length $1\frac{1}{4}$ line.

NERTHOMMA.

Head rather small, subquadrate; rostrum short, slightly pro-

duced, subemarginate. Antennæ scarcely longer than the body, arising from a round cavity beneath the eye; the first two joints short, tumid, third to the eighth linear-elongate, the last three forming a slender interrupted club. Eyes large, approximate, widely emarginate below. Palpi stout, subacuminate. Prothorax subquadrate, a little convex; carina rather distant from the base, terminating in a very slight curve at the side. Elytra moderately convex, the sides slightly rounded. Legs of moderate length, the first tarsal joint longer than the rest together.

Nerthomma stictica.

N. oblongo-ovata, tomentosa, brunnea, griseo-varia; elytris punctato-striatis, maculis griseis ornatis.

Hab. Borneo.

Oblong ovate, with a reddish-brown tomentum, varied on the prothorax with grey, so as to form a large central, and on each side three smaller ovate patches of reddish-brown; elytra punctato-striate, the base and several oblong spots on the alternate interstices grey; antennæ and legs dark brown; basal joints of the former, and eyes, yellowish brown; body beneath with a dark greyish silky pubescence. Length $2\frac{1}{2}$ lines.

EXILLIS.

Head small, subquadrate; rostrum short, rounded below, the apex entire. Antennæ very long, arising from a broad cavity immediately beneath the eye; the first two joints very short and tumid, the third to the eighth linear-elongate, subequal; the ninth shorter than the eighth, its apex and the tenth and eleventh joints forming a short slender club. Eyes distant, prominent, obliquely reniform. Prothorax subquadrate, rather convex, the carina nearly basal, terminating in a short curve at the side. Elytra short, the sides slightly rounded. Legs of moderate length, the first tarsal joint longer than the rest together.

Exillis longicornis.

E. ovatus, brunneus, subsericeo-griseo-tomentosus; antennis basi, pedibusque rufis.

Hab. Borneo.

Ovate, reddish brown, with a sparse silky greyish tomentum; elytra slightly striated; first three joints of the antennæ yellowish red, the rest dark brown; eyes and mandibles black; legs yellowish red, the tarsi darker. Length $1\frac{1}{4}$ line.

Mecocerus Wallacei.

M. fuscus, cinereo-irroratus; elytrorum dimidio apicali rufo-brunneo; antennis maris corpore duplo longioribus.

Hab. Borneo.

Finely tomentose, dark brown, sprinkled with ashy; rostrum

with a sparse greyish pubescence, and three strongly-marked costæ; disc of the prothorax with two slight impressions, one behind the other; elytra faintly punctato-striate, the posterior half reddish brown, and less spotted than the anterior portion; legs black varied with ashy, the bases of the first and last tarsal joints white; antennæ of the male twice as long as the body, black; beneath with a pale ashy pubescence. Length 7 lines.

Mecocerus simulator.

M. griseo-fuscus, cinereo-varius; elytris rufo-brunneis cinereo-maculatis; antennis maris vix corpore longioribus.

Hab. Borneo.

Finely tomentose, greyish brown varied with ashy; rostrum with a sparse greyish pubescence, and three strongly-marked costæ, the lateral one interrupted near the apex; prothorax with a slight impression on each side anteriorly; elytra punctato-striate, reddish brown, sparingly spotted with grey, a small tubercle on each posteriorly; legs black, one or two spots on the tibiæ and the first and last tarsal joints white at their bases; antennæ of the male only a little longer than the body; beneath with a pale greyish pubescence. Length 5 lines.

These two species are related to *M. disparipes*, Imh.; and the males appear to have the thorax unarmed. The *Macrocephalus variegatus* of Olivier, which Schönherr, not having seen it, referred to his genus *Ptychoderes*, appears to me to belong undoubtedly to *Mecocerus*. It is from Amboyna.

MYCTEIS.

Head narrow; rostrum long, contracted in the middle, gradually dilated below, the apex entire. Antennæ short, arising from an oblong shallow groove midway between the eye and root of the mandible; the first joint longer than the second, tumid, the rest of the funiculus slender; the club moderately thick; the joints attenuated at the base. Eyes approximate, round, entire. Labrum short, transverse. Mandibles long, strongly toothed. Palpi elongate, stout, subacuminate. Prothorax transverse, narrowed anteriorly, the sides slightly rounded, the carina subbasal, curved directly forward at the side. Scutellum transverse, subtriangular. Elytra widest at the base. Legs of moderate length, the anterior longest; the first tarsal joint longer than the rest together. Mesosternum short, transverse.

Mycteis marginicollis.

M. subovatus, fusco-tomentosus; prothoracis lateribus late albomarginatis, marginibus antice connexis.

Hab. Philippine Islands (Manilla?).

Subovate, covered with a short dense tomentum; head and

prothorax dark brown; on each side of the latter a broad white stripe, which, meeting anteriorly, is continued between the eyes; rostrum coarsely punctured; elytra slightly gibbous at the base, regularly punctured, dark brown, the alternate interstices obscurely spotted with fulvous brown; body beneath, antennæ and legs dull black; the tibiæ faintly annulated with white. Length 5 lines.

Mycteis frenatus.

M. subellipticus, griseo-fuscus; capite prothoraceque utrinque flavescente-vittatis.

Hab. Borneo.

Subelliptic, with a thin greyish-brown tomentum; rostrum coarsely punctured; a narrow yellowish stripe over each eye, extending obliquely backwards on the sides of the prothorax; elytra slightly gibbous at the base, punctato-striate, two or three of the alternate interstices in the middle of each slightly elevated and obscurely spotted with darker brown; body beneath, legs, and antennæ pale greyish brown. Length 4 lines.

Litocerus torosus.

L. subovatus, niger, prothorace elytrisque maculis, his plaga irregulari basali, tibiisque medio, rufo-cinerascentibus.

Hab. Borneo.

Subovate, black; disk of the prothorax with a transverse impressed line; head, spots on the prothorax (about twelve) and elytra, and on the latter a large irregular basal patch with a complicated and probably varying outline, and the middle of all the tibiæ pale reddish ashy; beneath brown, with a thin greyish pile. Length 3½ lines.

Litocerus pictus.

L. elongato-ovatus, fulvus; elytris antice maculis oblongis subconjunctis, postice fascia irregulari fuscis ornatis; tibiis quatuor posterioribus apice nigris.

Hab. Borneo.

Elongate-ovate, fulvous yellow; four stripes on the prothorax and four or five oblong spots on the elytra, which are more or less connected with each other longitudinally and with a broad irregular band behind, dark brown; the large fulvous patch at the apex, which is rounded anteriorly by the curvature of the band, with sometimes a small spot in its centre; antennæ brown, more than half the length of the body; eyes black; mandibles pitchy; legs pale fulvous, the apices of the four posterior tibiæ and the upper part of the posterior femora dark brown; beneath silky, grey. Length 3½ lines.

Litocerus litigiosus.

L. ovatus, niger; prothorace utrinque flavescente vittato; elytris maculis parvis flavescentibus ornatis; tarsorum articulo primo, basi excepta, flavescente.

Hab. Dorey.

Ovate, black; prothorax with a transversely impressed line interrupted in the middle, and a broad yellowish stripe on each side; elytra punctato-striate, with a few small scattered isolated yellowish spots, one larger than the rest, common to both elytra, near the scutellum; antennæ about half the length of the body, black, the funiculus rather stout, the two basal joints and bases of the fourth to the seventh, testaceous red; legs black, four posterior tibiæ in the middle and first joint of all the tarsi, except at the base, yellowish; beneath dark umber-brown. Length 3 lines.

Litocerus perplexus.

L. oblongo-ovatus, fuscus; prothoracis disco cruciatim rufo-cinerascente maculata, lateribus sub-bivittatis; elytris flavescentibus, antice fusco-maculatis, postice subundulatis; tarsorum articulo primo fusco.

Hab. Dorey.

Oblong-ovate, dark brown; prothorax with a reddish-ashy central stripe, and a transversely impressed line spotted at each end, together forming a cross-shaped mark, the sides also dull yellow, with an irregular brown line dividing it into two unequal stripes; elytra reddish ashy intimately mingled with brown, at the base assuming the form of spots, but posteriorly of waved bands interrupted at the suture near the apex; antennæ more than half the length of the body, the funiculus slender, testaceous yellow, the club brown; legs brown, tibiæ at the base and the three terminal joints of the tarsi dull testaceous. Length 3½ lines.

Litocerus divergens.

L. oblongo-ovatus, ater; prothorace vittis tribus, elytrisque singulis duabus una externa una suturali (medio divergente) grisescentibus.

Hab. Macassar.

Oblong-ovate, tomentose, black; head, sides of the rostrum, three stripes on the prothorax, and two on each elytron, one commencing at the angle of the shoulder and continued round to near the apex, the other behind the scutellum close to the suture, but soon diverging towards the centre, then again approaching and becoming sutural to the apex, pale greyish; antennæ less than half the length of the body, the funiculus pale, the club dark brown; legs dark brown, the femora ferru-

ginous, the tarsi short, clothed above with a greyish pile; beneath dull black. Length $3\frac{1}{4}$ lines.

Litocerus marginellus.

L. ovatus, ater; prothorace vittis tribus, elytrisque singulis duabus, una externa una suturali, lineisque duabus basalibus grisescentibus.

Hab. Macassar.

Ovate, tomentose, black; prothorax broader than long, with a transverse impressed line on its disk; head, sides of the rostrum, three stripes on the prothorax, and two on each elytron, one commencing at the shoulder and continued to near the apex, the other behind the scutellum and extended the whole length of the suture, and two narrow parallel lines at the base, pale greyish; antennæ scarcely extending beyond the base of the prothorax; legs dark brown, femora ferruginous at the base, tarsi short; beneath brown, with a greyish pile. Length $2\frac{1}{2}$ lines.

Litocerus passerinus.

L. oblongo-ovatus, grisescens; rostro argentato; prothoracis disco fusco griseo-cruciato, lateribus subbivittatis; elytris maculis lineisque curvatis fuscis; antennarum funiculo pedibusque testaceis.

Hab. Borneo.

Oblong-ovate, tomentose, greyish; prothorax brown, with an impressed transverse line and a central stripe forming a greyish cruciform mark, the side also greyish, but partially divided into two stripes by an irregular patch; elytra greyish fawn, spotted and marked with curved lines of brown at the base, sides, and sutural margin; funiculus of the antennæ and legs testaceous, club of the former dark brown; beneath greyish brown. Length 2 lines.

All the *Litoceri* described in this paper have been selected from a large number of specimens; and, after repeated examinations, I have seen none that can be considered intermediate or doubtful; it will be, however, as well to recollect that the coloration of individuals of the same species varies considerably,—isolated spots in one specimen, for instance, becoming, by their connexion, bands or stripes in others; and, again, the spot may disappear or be reduced to a line or point, and a complication is the result, which differs in that respect very widely, perhaps, from the description.

Anthribus Wallacei.

A. oblongo-ovatus, piceus, dense tomentosus, rufo-fuscus; protho-

race transverse trituberculato; elytris punctato-striatis, singulis trifasciculatis.

Hab. Aru.

Oblong-ovate, pitchy, covered with a dense reddish-brown tomentum; prothorax with three transversely placed tubercles on the middle of its disk; elytra strongly punctato-striate, the alternate interstices dark brown, with a few white hairs dispersed in spots, the third interstice from the suture with three dense fascicles of dark-brown hairs; eyes, mandibles, and antennæ black, the latter with their joints from the fourth to the eighth white at the apex, the ninth entirely white, except at its apex; legs and beneath brown varied with greyish. Length 8 lines.

The preceding notes having been extended to beyond what was originally contemplated, the species described have been placed without any regard to their natural affinities: there are still, however, many forms, particularly in the extensive private collections of Mr. Wallace, quite as remarkable as any yet published, besides a number of species referable to genera which I have here sought to establish*.

The following are represented on the two Plates :—

Plate I. *Hucus melanostoma, Mycteis marginicollis, Ethneca Bakewellii, Plintheria luctuosa, Nessia didyma, Esocus lachrymans, Dysnos auricomus, Apatenia viduata, Misthosima mera, Hypseus fascicularis, Phæochrotes porcellus, Eczesaris atomaria, Phaulimia ephippiata, Genethila retusa.*

Plate II. *Apolecta parvula* (Thomson), *Byastus cephalotes, Protædus mærens, Zygænodes Wollastoni, Dipieza Waterhousei, Nerthomma stictica, Exillis longicornis, Penestica inepta, Habrissus pilicornis,* and *Cedus tuberculatus.*

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

January 25, 1859.—E. W. H. Holdsworth, Esq., F.L.S., in the Chair.

On a Species of Eolis, and also a Species of Lomanotus new to Science; with the Description of a Specimen of Eolis cærulea of Montagu. By William Thompson.

My dredging labours in Weymouth Bay have again been rewarded by the acquisition of two new species of the Nudibranchs, and by the rediscovery of one of Montagu's lost species. This last acquisi-

* One of these (*Nessia*) may possibly be synonymous with *Dendropemon*, Schön., founded on a rare Fabrician insect from Sumatra, which I have not seen.

tion is very pleasing to me, believing, as I do, that all the species described by Montagu still exist. On a former occasion I was fortunate enough to obtain his *Thecacera pennigera*.

The species described in this paper I was anxious should not rest on my sole authority; added to which, I was not sufficiently versed in their anatomy to give an equally full description with those in the valuable work on the Nudibranchs published by the Ray Society. After I had taken my notes, I accordingly despatched them to Messrs. Alder and Hancock, who have kindly placed their descriptions at my disposal, and, in the interest of zoological science, I use their descriptions in preference to my own.

EOLIS ADELAIDÆ.

"Body nearly half an inch long, slender, tapering to a fine point behind, pellucid orange-red. Dorsal tentacles moderately long, smooth, tapering, divergent, and set a little apart at the base; orange-red with yellow tips, and a pale line down the back of each, terminating in a clear oval spot on each side behind the tentacles, on which the minute eyes are placed. Oral tentacles a little shorter than the dorsal pair, and of the same colour, the pale line on their surface also extending backward to the clear spot. Branchiæ elliptical, inflated, of the same colour as the body, a little deeper towards the top, apices white; the central gland is yellowish, rather wide, and irregularly folliculated or lobated; they are arranged in twelve or thirteen rather distant transverse rows of three or four papillæ each, commencing a little behind the tentacles, and divided by a narrow space down the back; the papillæ nearest the dorsal ridge are the largest and the most inflated. Foot pellucid, slightly tinged with orange-red, linear, narrow, tapering gradually to a point a little beyond the branchiæ behind, truncated in front, with the angles rounded off.

"This species most nearly approaches *Eolis Farranni*, Ald. & Han., from which it differs in colour, and in the number and form of its papillæ, which are broader towards the apex. The spawn also differs, forming a narrower coil, with the free margin undulated."

Hab. I obtained two specimens by dredging in six fathoms water in Weymouth Bay; the first, which was white in colour, I obtained in September 1854, and the second specimen was obtained in the following month. The colour of the last was orange-red; and this is described by Messrs. Alder and Hancock as the typical example. In each case the *Eolis* was feeding on *Plumularia*. The difference in the colour here shown is a further evidence of the puerility of considering mere colour as a test of species in the lower animals. I have named this lovely Nudibranch in memory of a little daughter, whose love for zoology, and retentive memory on the subject, promised much.

EOLIS CÆRULEA, Mont. sp.

Doris cærulea, Mont. Linn. Trans. vii. 78. pl. 7. f. 4, 5.

"Body half an inch long, slender, nearly linear, tapering to a fine point behind, of a pale pellucid green. Head small, very short, and

rounded in front, with a dark mark in front of the dorsal tentacles, caused by the buccal mass. Dorsal tentacles long, slightly tapering, tinged with green and speckled with opake yellow; points rather obtuse and spreading; bases closely approximating, with the eyes close to their outer margins. Oral tentacles greenish, very short and delicate. Branchiæ fusiform, almost linear, stoutish, moderately long; central gland not quite so wide as the sheath, irregularly folliculated and granulated, green below and dark blue above; outer surface of the papillæ above pale blue, below pale green; a few yellow freckles in front; tips strongly capped with rich orange-red, banded below with a rim of bright yellow: the extreme points are colourless and pellucid; they are arranged in ten transverse, rather distant rows of five or six papillæ in each row; the four anterior rows are rather closer together than the rest, and are divided from them by a widish space; the front row contains only two papillæ, placed as far forward as the dorsal tentacles. Foot tinged with green, narrow, slightly lobated in front, with the lateral angles considerably produced and rather obtuse."

This interesting individual was dredged by me in Weymouth Bay, on a rough bottom in six fathoms water, and sent to Mr. Albany Hancock in the latter part of September 1858. In the note accompanying this description, Messrs. Alder and Hancock remark, that "as Montagu's description of this very beautiful species is exceedingly short and incomplete, and as no one appears to have captured it since his time, it has been thought desirable to redescribe it. However, there can be no doubt that this is Montagu's species; and its rediscovery, which is due to Mr. Thompson, of Weymouth, is of great interest."

Lomanotus portlandicus.

"Body upwards of an inch and three-quarters long, depressed, quadrilateral, tapering a little backwards, pellucid white, tinged with brownish yellow on the back, in front pale orange-red. Head rounded in front, covered with a distinct veil, bearing on each side two rather long tentacular processes, the outer ones the longer. Tentacles set well forward and placed apart, elliptical, tapering to a pretty fine produced and truncated apex; closely laminated on the upper portion, which is of a pale yellowish colour, with numerous fine laminæ much inclined backwards and downwards, and divided in front by a narrow line; the lower portion, colourless and smooth, is contained within a tall, narrow sheath, of an orange-red colour above, with the margins divided into six finely-pointed filaments, those in front shortest. The sides of the back are produced into wide pallial margins, which, commencing in front of the bases of the tentacular sheaths, are continuous behind the termination of the tail; these margins are deeply and symmetrically undulated, forming on each side four loops, which meet along the medio-dorsal line, and are fringed with numerous short, pointed, orange-red papillæ tipped with white; the papillæ die out towards the tail, and are reduced in size on the part of the loop next the foot. Foot white, with the

margins nearly parallel, obtusely pointed behind, in front bilobed and deeply grooved, with the anterior lamina notched in the centre; the lateral angles much produced and recurved."

I obtained this species on two occasions. The first specimen was procured by me whilst dredging in Weymouth Bay, on the 15th of December 1855, and the second specimen in the same month of the following year. Both these individuals, as soon as I had completed my notes, I sent to Mr. Hancock, who received them in good condition, and who, in conjunction with Mr. Alder, I am happy to say, has made drawings of all the species described in this paper,—I trust, in order to enrich, at an early period, another number of their admirable work on the Nudibranchiate Mollusca. Mr. Hancock suggests for this species the specific name of *fimbriata*; but, whilst admitting the propriety of the name, I trust he will fall in with my wish of identifying the district in which it was first taken.

I would here draw attention to the irregular appearance of some of the Nudibranchs. Two species of *Doris*, formerly obtainable in Weymouth Bay in moderate abundance, are now scarce; *Eolis papillosa*, at one time very abundant, is now represented by an occasional specimen: these are all tidal species. *Eolis coronata* and *Landsburgi* were never very plentiful, and are not less scarce than formerly; but far different is it with *Polycera 4-lineata* and *Antiopa cristata*. Some three years since, we could obtain a dozen of each of these species any day—I have seen three in one net (both these species appear to be gregarious); whilst during the whole of the past summer my captures have not exceeded half a dozen of both species for the whole year. The dearth was occasioned by the severe winter we had some few years since, and which also destroyed many fish, and rendered *Adamsia palliata* very rare.

Description of Six hitherto Undescribed Species of Bats. By Robert F. Tomes.

1. Scotophilus microdon, n. s.

The present species is one having the same subgeneric characters as the common *Pipistrelle* of Europe and the *Scot. Greyii* and *S. pumilus* of Australia. To the latter species it is, by the form of its head and ears, most nearly affine, but may at once be distinguished from it by its greater size and by its smaller teeth.

The crown is but little elevated above the facial line; but the muzzle, although short, is more pointed than is usual in the flat-crowned species. The ears are very small, nearly as broad as high, with the outer margin slightly hollowed out about the middle, below which is a faintly developed lobe, and immediately above which is the tip of the ear,—the latter being obtusely angular, and directed outwards. The inner margin is very much rounded, especially at two-thirds of the distance from the base, where the convexity is so prominent as to be quite as high as the tip itself, the portion between this prominence and the tip being nearly horizontal. Altogether the ear bears some resemblance to that of *Miniopteris*. *Scot. pumilus* is the only species which has ears of form similar to

those of the present species; but they are, although the species is smaller, rather larger, relatively longer, and have their tips less outwardly directed, and more rounded. The tragus, as in all others of this group, is curved inwards, and rounded at the end; but it differs from that of some others, in being rather widest in the middle.

In relation to the size of the animal, the wings are rather ample, and rather broad for their length, the fourth finger (that which determines the breadth of the wing) being longer than the two basal phalanges of the longest finger*. All the wing-bones are somewhat slender. The thumb is rather long, not quite half enveloped in the membrane.

The legs are rather long and slender, the tibiæ being quite as long as in *S. Gouldii*, a species of greater size than the present; they are just twice the length of those of *S. pumilus*. The feet are large, about the length of those of *S. Leisleri* of Europe, the toes taking up half their entire length, and the wing-membranes extending to half the distance between the extremity of the tibia and the base of the toes. Tip of the tail enclosed in the membrane.

The fur of the head extends to rather near the end of the nose; and the upper lips are furnished with moustaches; so that the only naked space is around and in front of the eye. The fur of the back does not extend on to the interfemoral membrane, and only to a very limited extent on those of the wings; but that of the under parts encroaches on the membranes all round the body, especially beneath the arms, where it reaches nearly to the elbow. A straight line from that joint to the knee would pretty accurately define the hairy portions of the wing-membranes.

In quality the fur is soft, and rather long, bicoloured above and beneath. That of the back of a specimen from South Australia is dark brown at the root, with the terminal half of the hairs reddish-brown, uniformly of the latter colour around the rump and on the flanks; beneath, dark brown at the root, with the terminal third light cinnamon-brown, that on the membranes paler and unicoloured. Membranes lightish brown.

Another specimen from Van Diemen's Land differs only from the last in being much darker in colour; the fur of the upper parts black at the root, tipped with sepia-brown; beneath, the same, but the brown tips lighter and more tinged with rufous, especially that on the membranes and around the pubal region, where it is unicoloured and reddish-brown.

* In many species of this group the fourth finger is not more than equal in length to the two basal phalanges of the longest; and in the more typical species of the genus, such as the common Noctule, it does not extend much further than the middle of the second phalange of the longest finger. In making use of the relative lengths of the wing-bones, either as a generic or specific distinction, it is absolutely necessary that perfectly adult examples be examined; for, in those which are not, they vary so much with the age of the individual, as not only to be useless as a means of distinction, but to lead to absolute error and consequent confusion. Judging from the figure given by M. Temminck of *V. brachypterus*, I should expect to find his specimen with the apophyses of the phalanges of the fingers imperfectly ossified.

In the following table, the dimensions in column 1 are those of the South Australian specimen, those in column 2 of the one from Van Diemen's Land, whilst those in the 3rd have been taken from a specimen of *S. Greyii* from Port Essington (one of the types in the National Collection), and are added to show the difference in the size of the two species,—*S. Greyii* being the only Australian bat appertaining to this restricted group which approaches in size the species here described.

	1.		2.		3.	
	"	'''	"	'''	"	'''
Length of the head and body..	2	6	2	2	2	0
—— of the tail	1	8	1	5	1	3
—— of the head	0	7?	0	7	0	7
—— of the ears	0	3	0	3	0	4
—— of the tragus	0	2	0	2	0	$2\frac{1}{4}$
—— of the fore-arm	1	5	1	$6\frac{1}{2}$	1	$4\frac{1}{4}$
—— of the longest finger ..	2	8	2	10		
—— of the fourth finger....	2	0	2	1		
—— of the thumb	0	4	0	4		
—— of the tibia	0	8	0	$8\frac{1}{2}$	0	6
—— of the foot and claws ..	0	4	0	4	0	$3\frac{3}{4}$
—— of the *os calcis*	0	7	0	7		
Expanse of wings............	11	3	11	8	8	6

The teeth of this species, although not sufficiently examined to furnish a comparative description, are nevertheless seen at a glance to be of very small size, not only in reference to the size of the animal, but also actually smaller than those of several other species of much less size, such as *S. trilatitius*, *S. lobatus*, and *S. abramis*. Hence the specific name of *microdon* here bestowed upon it.

2. Scotophilus Darwini.

The next species which I have to describe has been presented to me by Mr. Darwin, with the information that it had been received from the Canary Isles.

In a collection of Bats from Madeira, given to me also by Mr. Darwin, I could only enumerate two species, both European, viz. *S. Leisleri* and *S. marginatus*; and I was somewhat surprised to find in the present species one which I had not before met with. None of the descriptions of African species in the works of Temminck, Wagner, Peters, Smith, and others, apply to this species; and I therefore regard it as new, and describe it as follows:—

It is one of the same group as the species just described, and as the *S. Kuhlii* and *S. pipistrellus* of Europe. It is characterized by a somewhat more robust make than those species, and has rather broader ears and tragi.

The head is rather broad and flat, the crown being but little raised above the facial line; the glands of the lips are considerably developed, and bulge sufficiently to occasion the nostrils to open nearly straight forward, although the interruption in the outer margins of the latter sufficiently indicates that with a more pointed

muzzle they would open sublaterally; were the specimen taken from the spirit in which it is preserved and dried, it is probable that this would be the case. In the middle of the face is a kind of hollow, occasioned by the labial glands on each side being developed in an upward direction, thus leaving a depression between them*. Between the nostrils is a space of moderate extent, and but very faintly emarginate. The ears are rather large, triangularly oval, as broad at the base as they are long, and have their tips brought to a rounded point; about the middle of their outer margin they have a distinct but shallow notch, below which is a lobular portion, as in many other species of this group, but differing from all others which I have seen in having a small but very well-defined notch about its middle. These organs altogether are more like those of *S. Kuhlii* than of any other species, but are larger, besides having the double emargination just noticed†. The tragus is rather short and broad, curved inwards, and with the end very much rounded; on its outer margin, near the base, is a projecting angular point, without any accompanying notch.

The wing-membranes extend to the base of the toes, and the latter are half the length of the foot. The thumb is moderate, with the basal phalange much the shortest. The terminal vertebra of the tail is free.

The fur of the head extends forwards to between the eyes, and thence in a narrow strip towards the nose. Over each eye is a wart bearing a bundle of stiff hairs; and a similar tuft springs from the top of the labial glands; the upper lips are also slightly fringed with similar hairs, most conspicuous about the corners of the mouth. The remainder of the face, the ears, and the tragus are naked. The fur of the back spreads on the upper surface of the interfemoral membrane, sparingly, for nearly half its length, as in *S. Kuhlii*, and similarly to a small extent on the membranes near the sides of the body. Beneath, the membrane immediately around the pubes is dusted with very short hairs, more abundant on the vertebræ of the tail than elsewhere. On the membrane contiguous to the sides of the body, fur of a much longer kind extends, to a much greater degree than in *S. Kuhlii*.

On both surfaces of the body the fur is bicoloured: above, very dark brown at the base, tipped with lighter and more rufous brown, that on the membranes wholly of the latter colour; beneath, it is dark at the base, tipped with paler brown, with less of the rufous tinge than that of the upper parts. On the under surface of the membranes the fur is uniformly of the same colour as the tips of the hairs on the belly, but on the pubes it is paler. Membranes dark brown.

Such appear to be the colours of the fur, so far as can be gathered from the examination of a specimen in spirit; but it is necessary to

* In the *Romicia calcarata* of Dr. Gray the lip-glands are so much developed as to leave a deep pit between them. It belongs to the present group.

† I am here comparing a specimen in spirit with others in skin,—a plan not always attended with perfectly satisfactory results.

consult others in skin before this point can be determined with accuracy.

Although in its external appearance *S. Darwini* bears considerable resemblance to *S. Kuhlii,* it differs, besides having a somewhat differently-shaped ear and broader tragus, in the form and arrangement of the fore teeth. In *S. Kuhlii* the upper incisors are rather long and slender; the inner ones are deeply forked at their apices, and longer than the outer ones, which are slender and pointed, somewhat like small canines; and there is a visible interval between the points of the inner and outer ones. In *S. Darwini,* on the contrary, they are short and obtuse, of nearly equal length, the inner ones faintly cleft at their points, and the outer ones so closely packed to them as to leave no space even between their points. Again in *S. Kuhlii* there is a space between the canine and the "*carnassier*" or sectorial tooth, in which is placed a small and conical premolar, within the line of the teeth, but distinctly visible from the outside; whereas in *S. Darwini* the canine and the "*carnassier*" are contiguous, and there is a very small anomalous premolar placed in the inner angle formed at their bases, visible only from inside.

These differences in the dentition are alone sufficient to distinguish the species from *S. Kuhlii.* From *S. marginatus, S. ursula,* and *S. Nathusii* it may be also recognized by the form of the upper incisors; and these are the only European species with which it could be confounded.

	″	‴
Length of the head and body	2	1
——— of the tail	1	5
——— of the head	0	8
——— of the ears	0	4½
——— of the tragus	0	2
Breadth of the tragus	0	1½
Length of the fore-arm	1	5
——— of the longest finger	2	6
——— of the fourth finger	1	8
——— of the thumb	0	2
——— of the tibia	0	6¼
——— of the foot and claws	0	3
——— of the *os calcis*	0	5
Expanse of wings	9	9

Hab. Palma, Canary Isles.

Obs. The Madeiran species being European ones, and one of them African also (i. e. *S. marginatus*), renders it not unlikely that the species inhabiting the Canaries may also occur in Africa, and perhaps in Europe. With a view to the chance of this, I have compared this species with what now remains of the types of *Vespertilio Aristippe, V. Leucippe, A. Alcythoe, V. vispistrellus,* and *V. Savii,* but find nothing which leads me to regard it as referable to any of them; and I have therefore given such a detailed description as will be amply sufficient to distinguish it from all recorded European species.

3. Vespertilio caliginosus, n. s.

This is one of the smallest species of the genus, being rather less than the *V. mystacinus* of Europe, which in general appearance it very much resembles. *Vespertilio parvulus*, Temm., is the only species of this restricted group which I have yet seen, that is smaller than the present one.

There are a few Asiatic species of Bats which possess the characters of the group of which *V. mystacinus* is typical, but which have the tragus much shorter and less acute, and not so much bent outwards. *Vesp. trilatitius*, Temm. (not Horsfield), and *V. tenuis* of the same zoologist, may be mentioned as examples; and the species I am about to describe will constitute a third.

The top of the head is rather elevated, about as much so as in *V. mystacinus*; and the muzzle is pointed as in that species, but is considerably shorter. The ears are rather small, and have narrow but rounded tips, are notched at their outer margin near the base, below which is a distinct rounded lobe, which is almost hidden in the long fur of the neck. The tragus is rather short, not quite half the length of the ear; its inner margin is straight; its outer one curves evenly from the base to the tip, in such a manner that it is of pretty uniform breadth for about half its length, from which it narrows to a subacute tip. The tragus of *V. mystacinus* is precisely of this form for two-thirds of its length,—the outer margin being convex, the acute tip being produced, or as it were added, and taking an outward curvature in the dried specimens, but straight when fresh or preserved in spirit. Near the base is a well-defined notch, dividing off an angular lobular portion, quite at the base. No such notch appears in the tragus of either *V. mystacinus* or *V. tenuis*.

The wings are proportioned much as in *V. tenuis*, excepting that the thumb is much smaller, whilst the bones of the wings, although this species is considerably less, are quite as stout as in that species. The feet are small, with toes which are rather more than half their entire length. Wing-membranes extending exactly to the base of the outer toe, which is much shorter than the others.

All the membranes are more strongly marked with lines than those of *V. tenuis*, and especially the interfemoral, on which may be counted as many as fifteen or sixteen transverse dotted lines, each dot bearing on the under side of the membrane one or more fine, short, bristle-like hairs. In *V. tenuis* about a dozen such lines may be observed.

Nearly the whole of the face is covered with thick soft hair, wanting only on the end of the snout, the front of the under lip, and immediately around the eye. On the glands of the upper lip it takes the form of two distinct tufts, projecting laterally, having the appearance of whiskers. In front of each eye is a single long hair, and a few other similar but shorter ones project from the upper lip and the chin. The fur of both surfaces of the body extends on to the interfemoral membrane very slightly; but the wing-membranes are free from hair.

On all parts of the body the fur is long and soft, and rather silky; and it is bicoloured above and beneath. That of all the upper parts is black at the base, more or less tipped with shining yellowish-chestnut, on the head and neck scarcely perceptible, but becoming more marked towards the middle of the back and on the rump, where it is much the brightest. Some of the darker examples of *V. mystacinus* bear some resemblance to the present species in this respect, but are less bright. Beneath, the fur is dead black, with the tips of the hairs greyish-brown, a little paler on the pubes.

Membranes and naked parts dark brown. The complete ossification of the finger-joints indicates that the specimen is adult; but the sex has not been ascertained.

	"	‴
Length of the head and body	1	6
——— of the tail, about	1	0
——— of the head	0	6
——— of the ears	0	4
——— of the tragus	0	$2\frac{1}{4}$
——— of the fore-arm	1	$2\frac{1}{2}$
——— of the longest finger	2	2
——— of the fourth finger	1	6
——— of the thumb	0	2
——— of the tibia	0	6
——— of the foot and claws	0	$2\frac{3}{4}$
Expanse of wings	8	6

Hab. I received this with a number of other Indian species from Mr. Warwick, with the statement that they all formed a part of a collection made by Capt. Boys. Amongst them were several specimens of *Scot. coromandelicus*; and the present species was confounded with them, until they were mounted for the cabinet, when the differences became sufficiently obvious.

4. Vespertilio sericeus, n. s.

A species remarkable for the great beauty of its fur, which is thick, very soft, and with all the gloss of unspun silk. In size and proportions somewhat similar to *V. Nattereri*, and the crown of the head elevated about as in that species; but the muzzle, although pointed, relatively a little shorter. Unfortunately the ears and tragi have been so much injured as to render it impossible to give an exact description of them; but it is evident that the ears were rather narrow, and more or less emarginate at their outer margin; and that the tragus was long and narrow, may be seen from what remains of one of them, the end only being lost.

The organs of flight are of medium size and proportions; the thumb is rather long, and has the basal phalange short, and the claw long and slender, with but a slight degree of curvature. The wing-membranes spring from the base of the toes. The feet are rather large,—the toes taking up a little more than half their entire length, and armed with claws, which, like those of the thumbs, are

rather long, slender, and but little curved. These parts have much the size and proportions of those of *V. Nattereri.*

Nearly the whole of the face is hairy; but there is a naked space around each eye. A thick moustache borders the upper lips, which, extending from the angles of the mouth upwards and forwards, joins the fur of the forehead, which extends nearly to the end of the nose. The chin is destitute of hairs. The fur of the back encroaches to a trifling degree on the interfemoral membrane; and the same may be said of that of the belly; everywhere else the membranes are naked.

On all parts of the body the fur is bicoloured: above dark brown at the root, with the terminal third light reddish-brown; beneath similar, but the brown at the root darker and more extended, the tips of the hairs for one-fourth only of their length being greyish-brown, on the abdomen whitish-brown.

Everywhere the fur maintains its peculiar silky lustre, as much so on the under as on the upper parts of the body. This quality of fur will at once distinguish this species from every other which I have ever seen.

The dentition, as far as it can be studied in a stuffed specimen, is as follows:—Upper incisors in pairs, placed close together, with a considerable interval in the centre between the pairs, and also an interval on each side, between them and the canines. They are rather short and obtusely conical, the inner ones indistinctly bifid at the apex. The canines are rather small and short, and are followed by two small premolars on each side, of a bluntly conical form, the first being the larger of the two. To these succeed the two large premolars, or *carnassiers,* in this species with the point only a little raised above the crowns of the true molars. In the lower jaw the incisors, six in number, are somewhat irregularly ranged and trilobed, the canines short, and the two following premolars on each side of equal size, small and conical. The next premolar is of greater size and more acutely conical. The chief peculiarity in the dentition of this species is the shortness of the teeth, whilst they maintain throughout a medium degree of stoutness.

	"	'''
Length of the head and body, about	2	0
——— of the tail	1	5
——— of the head	0	9
——— of the fore-arm	1	5
——— of the longest finger	2	4
——— of the fourth finger	1	$9\frac{1}{2}$
——— of the thumb and claw...........	0	$3\frac{3}{4}$
——— of the tibia	0	8
——— of the foot and claws	0	$4\frac{2}{3}$
Expanse of wings	10	0

Hab. Not known.

5. Phyllorhina aurita, n. s.

In size this species about equals *Rhinolophus hippocrepis* of Europe.

It may be readily distinguished from all others of the genus by the great size of its ears, and seems to hold the same position amongst the species of *Phyllorhina* that *Rhinolophus cornutus* does in the genus *Rhinolophus*.

So far as may be learned from the inspection of a specimen in skin, the facial crests greatly resemble those of *Ph. bicolor*, and the general form of the whole head, face, and ears is pretty much as in that species, excepting that the muzzle is relatively a little more compressed, and the ears much larger. These latter organs are one-fourth longer than the head, and of a broadly ovoid form, are somewhat diaphanous, and thickly marked with glandular dots. They have about sixteen transverse sulci, which do not quite extend to the outer margin of the ear, but are bounded by a well-defined line which runs parallel with the margin, and divides off a narrow portion, having the appearance of a distinct border. The inner or front margin of the ear has three such parallel lines, all running from that part of the ear which is near to the face, to near the tip. This peculiarity of having the ears margined as described, and the central part sulcated, is not confined to this species; but it is much more strongly marked in this than in any other which I have seen. *Ph. cervina* and *Ph. caffra* exhibit the same arrangement of lines in the ear, but in a much less degree.

The wings are broad for their length,—the fourth finger, which determines their breadth, being longer than the third*. They are distinctly reticulated, especially near the side of the body. No great peculiarities are exhibited by the posterior extremities.

The fur is strictly confined to the body, with the exception of some on the hinder surface of the ears, at their base, and a narrow fringe on one of the lines bordering their front margin inside the ear.

On all the upper parts the fur is bicoloured, nearly white at the base for three-fourths of its length, then of a medium brown colour, with the extreme tips a little paler, giving a slightly hoary appearance. Beneath, it is somewhat similar, but rather paler, especially on the humeral region and down the sides of the body; but the colours are less clearly made out. On the throat and along the middle of the belly to the pubes it is much lighter in colour, and almost unicoloured. The membranes are of a medium brown colour.

The teeth have not been examined with care, but appear to be rather long, especially the canines. They are longer than those of *Ph. cervina*, which is a slightly larger species.

* In *Rhinolophus hippocrepis* these two fingers are of equal length; and the same is the case in *Ph. caffra*, *Ph. speoris*, *Ph. labuanensis*, and *Ph. cervina*: in *Ph. nobilis* and *Ph. insignis* the third is a little longer than the fourth, whilst in *Ph. bicolor* and the present species the fourth is the longer of the two. Of course this difference in the relative lengths of the fingers determines the comparative breadth of the wings.

	"	‴
Length of the head and body	1	9
—— of the tail	1	0
—— of the head	0	8
—— of the ears	0	9½
Breadth of the ears, nearly	0	9
Length of the fore-arm	1	5½
—— of the longest finger	2	3
—— of the third finger	1	9
—— of the fourth finger	1	11
—— of the thumb	0	4
—— of the tibia	0	8
—— of the foot and claws	0	3½
—— of the *os calcis*	0	4½
Expanse of wings	9	9

Hab. Unknown.

6. Emballonura fuliginosa, n. s.

In general form this species somewhat resembles *E. monticola*, but differs in several important particulars. It is larger; and it has the fur of a uniform sooty brown, whilst in that species it is marked bicoloured, being nearly white at the root.

In its general outline the head is very similar to that of the other species of the genus; but the snout, although small and elongated, is not so pointed as in the American species, but is nevertheless more so than in the African *E. afra*, judging from the figure given by Dr. Peters. The nostrils are small and rather near together; the ears triangularly oval, longer than broad, with the outer margin entire and produced at the base along the face in a line midway between the cleft of the mouth and the eye, and ending immediately between the latter and the angle of the mouth, which are both in a vertical line: all three are therefore in a vertical line. The tragus has its two sides nearly parallel, but it is a little widest at the end; it curves slightly inwards, and has the end rounded as in the genus *Miniopteris*, but is relatively broader. Thumb rather long, with the two visible phalanges equal in length (the small terminal one, bearing the claw, being excepted), the basal one wholly enclosed in the interbrachial membrane. Wing-membranes extending to the distal extremity of the tibiæ; hinder limbs rather long and slender; toes half the length of the entire foot. *Os calcis* long; interfemoral membrane very ample, with three diverging lines from the tip of the tail to its hinder margin, one on each side of these from the root of the femur to the point of the *os calcis*, and two others, one from the distal extremity of each femur to near the middle of the *os calcis*. Transversely, this membrane has about twenty closely dotted lines.

The fur on the crown is long and thick, and approaches rather nearly the end of the nose; the sides of the face, from the auditory openings through the eyes to the upper lip, naked, or nearly so; but the upper lip is fringed with scattered short bristly hairs. The

extreme margin of the lips, both above and below, are naked and smooth.

That part of the wing-membranes which is contiguous to the under surface of the body is a little hairy; and the fur of the rump extends, to a very trifling degree, on to the interfemoral; but all other parts of the membranes are perfectly naked.

On all parts of the body the fur is rather soft, thick, and long, and perfectly devoid of lustre. It is also perfectly unicoloured everywhere, being above of a deep sooty brown with a slight tinge of rusty, and similar, though a little paler, beneath.

Upper incisors, 4, in pairs as in *Vespertilio*; they are very small, narrow near the alveolus, and blunt at the tips. Upper canines furnished with a kind of lobe or talon behind, at the base; the lower ones with a similar one in front. Lower incisors very small, symmetrically ranged, and with their cutting edges lobated.

	"	'''
Length of the head and body, about	2	0
——— of the tail	0	7 or 8?
——— of the head	0	9
——— of the ears	0	$5\frac{1}{2}$
——— of the tragus	0	2
——— of the fore-arm	1	9
——— of the longest finger	2	9
——— of the fourth finger	1	10
——— of the thumb	0	4
——— of the tibia	0	$8\frac{1}{2}$
——— of the foot and claws	0	$3\frac{1}{2}$
——— of the *os calcis*	0	$8\frac{1}{2}$
——— from the end of the nose to the hinder margin of the interfemoral membrane	3	6
Expanse of wings	12	0

Hab. "Island of Ovalee (Figi Islands), August 1856, H.M.S. 'Herald,' F. M. Rayner." Such was the label attached to the specimen when it recently reached Dr. Gray, through whose kindness I am enabled to give the above description.

Obs. Several species of Cheiroptera have fur of much the same quality and appearance as this species. *Nyctophilus unicolor*, from Van Diemen's Land, *Molossus norfolciensis*, Norfolk Island, and *M. acetabulosus*, Mauritius and Natal, are amongst these; and the American species *M. nasutus* also has fur which approaches closely in texture that of all these species.

The present species, although it differs materially from *E. monticola*, yet bears greater resemblance to it in the form of the head, ears, &c. than to any other species. To the African species, *E. afra*, Peters, it has some similarity in the form of the snout; and all these three are species which appertain to the genus *Emballonura* as restricted by M. Paul Gervais, who separates, under the name of *Proboscidea*, those species which have a longer and more pointed snout, such as *E. saxatilis* and *E. villosa*.

February 8, 1859.—Dr. Gray, V.P., in the Chair.

On the Members of the Genus Rupicola, and whether there be Two or more Species. By John Gould, Esq., F.R.S.

At present only two species of this splendid group of birds have been characterized, namely the *Rupicola crocea* and *R. peruviana.* It is true that several other specific names have been proposed by various writers, such as *aurantia, cayana,* and *elegans*; but I believe these terms all have reference to the first-mentioned species—the *Pipra rupicola* of Linnæus, the *Rupicola crocea* of Bonnaterre—a bird sent to Europe, and particularly to France, in the greatest abundance from Cayenne. There can be no doubt that the second species, the *R. peruviana* of Latham, is distinct from the *R. crocea*; but there is much doubt as to whether the specimens sent from Bogota be identical with the *R. peruviana,* since it is not to be found in the intervening country of Ecuador, whence we have long received a splendid bird, which I believe is not yet described, and to which I propose to give the name of *R. sanguinolenta.* At all events I have signally failed in my endeavours to see a male specimen of a Cock of the Rock from Peru, by which means alone the question can be determined; on the other hand, I have a female or young male from that country, which appears to differ from the females or young specimens from Bogota. In the present state of our knowledge of the subject, it will be advisable to leave the point undecided, and describe the bird from Ecuador, which is at once distinguished from its congeners by the deep blood-red colouring of its plumage, as compared with the bird from Bogota; it also differs in its smaller size, and in the relative lengths of its wings and tail. Before describing the *R. sanguinolenta,* I may mention that specimens of *R. crocea* from Demerara, although very similar in colour to those sent from Cayenne, differ considerably in the form and size of the crest,—that of the Demerara specimens being much smaller and rounder, and having the terminal crescent of brown much darker than in the more dilated crest of the Cayenne birds.

Rupicola sanguinolenta.

Crest (which is destitute of the terminal crescentic brown mark observable in the other species), the entire plumage of the body, the lesser wing-coverts, the under wing-coverts, and the thighs rich blood-red; the greater wing-coverts, wings, tail, and the extremities of the larger under wing-coverts velvety-black; tertiaries very broad, and of a fine silvery grey; bill and feet yellow.

Total length 12 inches, bill $1\frac{3}{8}$, wing 7, tail 5, tarsi $1\frac{1}{8}$.

On a New Species of Dendrochelidon, or Tree Swift. By John Gould, Esq., F.R.S., etc.

The highly interesting group of Tree Swifts forming the genus *Dendrochelidon* has recently been augmented by the discovery of a new species in Celebes by Mr. Wallace—the fifth of the form with

which we are now acquainted—the four previously known being the splendid *D. mystaceus* of New Guinea and the Aru Islands, the *D. comatus* of Manilla and Malasia, the old *D. klecho* of Java, and the *D. coronatus* of India. The new species (which is the second in size, being only exceeded in this respect by the *D. mystaceus*) is, as already stated, from Macassar, Celebes; it is most nearly allied to the *D. comatus* and *D. klecho*, but differs from both those birds in its much larger size, and in the deep-blue colouring of its shoulders and wings. This bird, which I have named *Wallacii* in honour of its discoverer, may be thus described:—

DENDROCHELIDON WALLACII.

Crown of the head deep green, with steel-blue reflexions; lores black; over each eye an indistinct stripe of greyish-white; sides and back of the neck and the upper part of the back green, passing into grey on the lower part of the back and rump, which colour again passes into the bluish-green of the upper tail-coverts; shoulders blue, with reflexions of green; primaries bluish-black, with green reflexions; tertiaries greyish-white; tail bluish-black; throat and under surface grey, passing into greyish-white on the vent and under tail-coverts; bill and feet olive.

Total length 10 inches; bill, from gape to tip, $\frac{1}{2}$; wing $7\frac{3}{8}$, tail $5\frac{1}{8}$.

Remark.—The usual chestnut-coloured mark immediately below the ear, indicative of the male, occurs in this as in the other members of the genus.

ON THE SEA BEAR OF FOSTER, THE URSUS MARINUS OF STELLER, ARCTOCEPHALUS URSINUS OF AUTHORS. BY DR. GRAY, F.R.S., V.P.Z.S., P. ENT. SOC.

Steller figures and describes a large Seal under the name of *Ursus marinus* (Nov. Comm. Petrop. ii. 331, t. 15), which is the authority for the Ursine Seal of Pennant (Quad. ii. 526) and *Phoca ursina* of Schreber, Gmelin, and most succeeding authors.

Forster, in Cook's 'Second Voyage' (ii. 203), appears to speak of the same animal under the name of "Sea Bear."

I had not been able to see a specimen of this species in any of the Museums which I had examined on the Continent or in England, or to find a skull of the genus from the Northern Pacific Ocean; yet I felt so assured, from Steller's description and the geographical position, that it must be distinct from the Eared Fur-Seals from the Antarctic Ocean and Australia, with which it has been usually confounded, that, in my 'Catalogue of Seals in the Collection of the British Museum,' I regarded it as a distinct species under the name of *Arctocephalus ursinus*, giving an abridgment of Steller's description as its specific character.

The British Museum has just received, under the name *Otaria leonina*, from Amsterdam, a specimen of the Sea Bear from Behring's Straits, which was obtained from St. Petersburg. It is evidently not an *Otaria*, but a true *Arctocephalus*, and agrees in all its cha-

racters with the Sea Bear, *Ursus marinus* of Steller, and not with the Sea Lion or *Leo marinus* of that author, which is called *Otaria Stelleri* in my catalogues, and was confounded with *Otaria leonina* of the Southern Pacific Ocean by Nilsson and most modern authors. The latter animal is still a desideratum in the British Museum and other European Collections.

The skin is 8 feet long, and agrees in all particulars with Steller's description of the adult male of the species, and is most distinct in external character and colour from the Fur-Seal (*A. falklandicus*) of the Falkland Islands and of *A. lobatus* from Australia.

The skull is equally distinct from the various skulls of all the species of the genus *Arctocephalus* (both Fur- and Hair-Seals) which are in the collection of the British Museum, and is easily known from them by the shortness of the face and the height and convexity of the nose.

The skull of this specimen is quite distinct from the skull of the *Arctocephalus Gilliespii* of California, recently described by Dr. Mac Bain in the 'Proceedings of the Physical Society of Edinburgh,' under the name of *Otaria Gilliespii*, from a skull in the Edinburgh Natural History Museum, of which we have a cast in the British Museum: but we are not able to ascertain with certainty whether this is a Fur- or Hair-Seal, though, from the length of the palate, compared with the width of the skull at the hinder grinders, I am induced to believe that it may belong to an animal which has a soft under fur. This proves that the Seals from the different parts of the West Coast of America are distinct from each other, each specimen having a specific geographical range.

Arctocephalus ursinus. Northern Fur-Seal.

Adult male grey-black; hair of the back long, black, reddish, with a subterminal band and a short grey tip; under fur short, woolly, red; the hair of the neck and front of the body longer, forming a kind of mane; lips and nose reddish; whiskers very long, strong, white, smooth, tapering to a fine point. Skull short, forehead very convex and rounded.

Hab. Behring's Straits.

I may state that the name *Arctocephalus ursinus* is usually applied to the various species of Eared Fur-Seals found in the different English and Continental Museums.

Description of a New Species of Fish, Peristethus Rieffeli. By Prof. Dr. Kaup.

This new species is an inhabitant of the seas of China and perhaps Japan, and shows, with a species of Japan and two of the Moluccas, that the Mediterranean species is not so isolated as we have hitherto believed.

The genus *Peristethus* (*Peristedion*) is to be placed in the middle of the subfamily *Triglinæ*, and connects the similar forms of *Dactyloptera* with those which are near to the genus *Trigla*.

The highest genera, *Cephalacanthus* and *Dactyloptera*, have no separated rays on the pectorals, a thorn-shaped prolongation of the preopercle, and a normal covering of scales without a trace of lateral line.

The lowest group shows also a high, less obtuse head, and three free articulated rays on the pectorals, small scales, and a distinct lateral line. To this section belong *Prionotus* and *Trigla*.

The genus *Peristethus*, which connects both groups, has only two articulated rays before the pectorals; and before the commencement of the small furcated caudal are three carinated scales, of which there are two only in *Dactyloptera*. The strongly-armed body is without a lateral line.

From these characters, this genus is more allied to the last than the first group. As in *Trigla lyra*, the snout is furcated, and along the dorsal line is a series of elevated thorns, by which the dorsals are placed in a more or less deep furrow.

If we see marks enough to connect *Peristethus* with one or the other group, there is also a series of characters by which this genus differs from all the others. *Peristethus* shows no trace of teeth in either jaw; and the symphysis of the lower jaw has fringed skin-flaps, more or less moveable, hanging downwards. The head is long and very compressed, with two fork-shaped prolongations on the end of the snout. Every part of this fork is rough on the margins, and on its lower part are four cavities covered with a thin transparent skin. The long head is only three times the length of the body; and the body has a pyramidal form with eight sides. All the scales are connected one with another, and have in the middle a thorn directed backwards. The pectorals are of middle length, not quite reaching the ventrals, and show only two free fingers. The over-breast and belly are of two shields, with a serrated suture in the middle, and elevated on the margins; the first shield is larger and longer than the second, which is rarely separated in two.

The dorsal commences on the second ring of the body and reaches not quite to the end of the body. The males are distinguished by the first rays of the dorsal being thin, filiform, and elongated. This is the case in the European species; and the others are no exception. The anal commences next the anal ring, and is as long as the second dorsal.

The colour is red; but this colour changes after death to a dirty ochreous-yellow.

The flesh of the smaller species is very dry and is not used. The Mediterranean species is not rare, but the fishermen take it only as a curiosity. The cavities in the two branches of the fork make it very weak and fragile; and most examples of these fishes have lost one or both parts of their fork.

In quite perfect specimens we never find the fork longer than an inch; therefore the horned fish of Pliny must be distinct from the Mediterranean fish. This horned fish of Pliny had horns 18 inches in length, and is, according to the opinion of Cuvier and Valenciennes, the *Cephaloptera*, which Rondelet has never seen or described.

It is, in fact, curious, that the old authors never mention the *Cataphractus*,—the reason probably being its rare appearance, its smallness, and its bad flesh.

As I always place the smallest forms with the most rounded skull at the head, and give the bird-types with the largest pectorals, which enable these forms to fly, the second place, and as I see in the *Peristethus* the bone- or reptile-fish, and in *Prionotus* the real fish-type, my arrangement of the genera in this little subfamily is as follows :—

I. Cephalacanthus.
II. Dactyloptera.
III. Peristethus.
IV. Prionotus.
V. Trigla.

After this preface, we proceed to distinguish the different species of

Genus III. Peristethus (Peristedion *).

Peristethus cataphractus.

Peristedion cataphractum, Lac.
P. cataphractum (♂) *et chabrontera* (♀), Risso, iii. p. 402.
Octonus holosteon, Raf.
Trigla hispanorum chabrontera, Osb.
Trigla hamata, Bl. Schn.
Malarmat, Rond. p. 237 (♂), excellent fig.; Cuvier & Val. iv. p. 101 (♂), excellent fig.
Peristedion malamart, Yarr. p. 67 (♂), excellent fig.

The figure of Bloch, t. 49 (♂), is bad, shows too many scales and rays in the second dorsal.

Diagn.—Front with three thorns. Eye-covers with thorns. Preopercle leaf-shaped, without prolongation. The length of the head to the breadth under the middle of the eyes as $2\frac{7}{12}:1$. Breadth of the head nearly equal to its height, measured under the eyes. The forks more or less divergent.

Not exceeding the length of a foot. Common in the Mediterranean, more rare in the Channel.

Peristethus orientalis.

Peristedion orientale, T. & Schleg. Fn. Jap. t. xiv. f. 5, 6; t. xv. f. 1, 2.

Similar in length to *P. cataphractus*, but without thorns on the front, and eye-covering. A female, besides the short rays of the first dorsal, shows the ventral shield separated into two, which is abnormal. On the symphysis are three small skin prolongations, and behind it a longer one.

I find the true specific character in the form of the head, and therefore doubt whether the number of the rays shows a great difference from the other species.

* The name *Peristedion* is wrongly formed.

Peristethus Rieffeli, Kaup.

Thorns on the front, not on the eye-margins; parts of the fork broader, and convergent towards the end. The breadth of the head is to the length as $1 : 1\frac{3}{5}$. The height of the head not quite half the breadth. The thorn-shaped prolongation of the preopercle not comparable with those of *P. cataphractus* and *P. orientalis*. The eyes are proportionately smaller, the front narrower and more concave, than in *P. cataphractus* and *P. orientalis*.

When we compare its head with those of the other species, we are led to believe that such a head belongs to a larger fish, which, however, is not the case. Our fish is scarcely larger than a large individual of *P. cataphractus*. In one cavity of the eye of a dry example I found a piece of China paper with the written characters of the country. From that, and the maceration and the varnish, I believe that this example came in an insect-box from China; it is, judging by the short rays of the first dorsal, a female.

I have named this very interesting species in honour of the memory of my true and excellent friend Dr. Rieffel, who has done so much for our Museum and University.

Besides these smaller species of *Peristethus*, there appear to be two mentioned by older authors, which attain an immense size. The first I call

Peristethus gigas.

Length 3 feet, of which the head is one-third.

In Valentyn, 'Oud en nieuw Ostindien,' tom. iii. p. 363, fig. 55, is a fish mentioned and figured under the name Tkan Scythân Merah (Red Devil Fish), which belongs, according to Cuvier, to this genus.

A bad plate of this is also given in Renard's 'Poissons et Ecrevisses,' fig. 67. What makes me doubt whether Renard copied the engraving of Valentyn, is that on the surface of the fork are cavities covered with membranes, which we do not see in the figure of Valentyn. Therefore I believe that both authors used one and the same painting belonging to another collection, made at Amboyna.

These cavities on the upper side of the bifurcated snout, which we find in the better known species on the under side, permit us to hazard two conjectures. Either this species has these cavities on both sides of the fork, or, by the mistake of the first artist, the cavities of the under side are erroneously placed on the upper side.

According to Renard, this fish reaches the length of 8 feet 7 inches; but this does not agree with the assertion of Valentyn. According to the latter, the flesh of this fish is dry and without flavour; Renard says it is similar to that of the Sturgeon. The last opinion is certainly not founded on experience, but on the analogy of this fish with the Sturgeon. I have more confidence in old Valentyn than Renard, and consequently think that the size of 8 feet is an exaggeration, and that the length given by Valentyn is the more exact.

Another species, not yet rediscovered,

Peristethus brevifurcatus,

is figured, according to Cuvier and Valenciennes, in Cornelius v.

Vlaming's Manuscript, nos. 165, 166. This fish is called Sturgeon of Banda, and has the fork of the snout not more largely developed than in *Trigla lyra*. Like *P. gigas*, it grows to a considerable size.

A third species is mentioned by Cuvier in few words: "Ainsi l'on doit croire qu'il y a dans la mer des Indes une espèce de ce genre différente de la nôtre." This third species of Cuvier is perhaps *P. orientalis*, or my new *P. Rieffeli*.

GEOLOGICAL SOCIETY.

December 14, 1859.—Prof. J. Phillips, President, in the Chair.

The following communications were read:—

1. "On some Remains of *Polyptychodon* from Dorking." By Prof. Owen, F.R.S., F.G.S.

Referring to the genus of Saurians which he had founded in 1841 on certain large detached teeth from the Cretaceous beds of Kent and Sussex, and which genus, in reference to the many-ridged or folded character of the enamel of those teeth, he had proposed to call *Polyptychodon*, Prof. Owen noticed the successive discoveries of portions of jaws, one showing the thecodont implantation of those teeth, which, with the shape and proportions of the teeth, led him to suspect the crocodilian affinities of *Polyptychodon*; and the subsequent discovery of bones in a Lower Greensand quarry at Hythe, which, on the hypothesis of their having belonged to *Polyptychodon*, had led him to suspect that the genus conformed to the Plesiosauroid type.

The fossils now exhibited by Mr. G. Cubitt of Denbies, consisted of part of the cranium (showing a large foramen parietale), fragments of the upper and lower jaws and teeth, of the *Polyptychodon interruptus*, from the Lower Chalk of Dorking, and afforded further evidence of the plesiosauroid affinities of the genus. Professor Owen remarked that in a collection of fossils from the Upper Greensand near Cambridge, now in the Woodwardian Museum, and in another collection of fossils from the Greensand beds near Kursk in Russia, submitted to the Professor's examination by Col. Kiprianoff, there are teeth of *Polyptychodon*, associated with plesiosauroid vertebræ of the same proportional magnitude, and with portions of large limb-bones, without medullary cavity, and of plesiosauroid shape.

Thus the evidence at present obtained respecting this huge, but hitherto problematical, carnivorous Saurian of the Cretaceous period seemed to prove it to be a marine one, more closely adhering to the prevailing type of the Sea-lizards of the great mesozoic epoch, then drawing to its close, than to the *Mosasaurus* of the Upper Chalk, which, by its vertebral, palatal, and dental characters, seemed to foreshadow the Saurian type to follow.

Prof. Owen exhibited also drawings of specimens in the Woodwardian Museum and in the Collection of Mr. W. Harris, of Charing, which show the mode and degree of use or abrasion to which the teeth of *Polyptychodon* had been subject.

2. "On some Fossils from near Bahia, South America." By S. Allport, Esq. Communicated by Prof. Morris, F.G.S.

The south-west point of the hill on which the Fort of Montserrate is built, in Bahia Bay, exhibits a section of alternating beds of conglomerate, sandstone, and shale; in the last Mr. Allport discovered a large Dinosaurian dorsal vertebra, not unlike that of *Megalosaurus*, several Crocodilian teeth, and numerous large scales of *Lepidotus*, together with a few Molluscs (*Paludina*, *Unio*, &c.), some *Entomostraca*, and Lignite. Two miles from Montserrate, in a N.E. direction, is the Plantaforma, another hill of the same formation, but loftier. The shales here also yielded similar fossils.

These fossiliferous shales and conglomerates dip to the N.W. towards the Bay, and appear to overlie a similarly inclined whitish sandstone, which rests against the gneissose hills ranging north-eastwardly from the point of St. Antonio.

3. "On a Terrestrial Mollusc, a Chilognathous Myriapod, and some new species of Reptiles, from the Coal-formation of Nova Scotia." By J. W. Dawson, LL.D., F.G.S. &c.

On revisiting the South Joggins in the past summer, Dr. Dawson had the opportunity of examining the interior of another erect tree in the same bed which had afforded the fossil stump from which the remains of *Dendrerpeton Acadianum* and other terrestrial animals were obtained in 1851 by Sir C. Lyell and himself. This second trunk was about 15 inches in diameter, and was much more richly stored with animal remains than that previously met with. There were here numerous specimens of the land-shell found in the tree previously discovered in this bed,—several individuals of an articulated animal, probably a Myriapod,—portions of two skeletons of *Dendrerpeton*,—and seven small skeletons belonging to another Reptilian genus, and probably to three species.

The bottom of the trunk was floored with a thin layer of carbonized bark. On this was a bed of fragments of mineral charcoal (having Sigillaroid cell-structure), an inch thick, with a few Reptilian bones and a *Sternbergia*-cast. Above this, the trunk was occupied, to a height of about 6 inches, with a hard black laminated material, consisting of fine sand and carbonized vegetable matter, cemented by carbonate of lime. In this occurred most of the animal remains, with coprolites, and with leaves of *Noeggerathia* (*Poacites*), *Carpolithes*, and *Calamites*, also many small pieces of mineral charcoal showing the structures of *Lepidodendron*, *Stigmaria*, and the leaf-stalks of Ferns. The upper part of this carbonaceous mass alternated with fine grey sandstone, which filled the remainder of the trunk as far as seen. The author remarked that this tree, like other erect *Sigillariæ* in this section, became hollow by decay, after having been more or less buried in sediment; but that, unlike most others, it remained hollow for some time in the soil of a forest, receiving small quantities of earthy and vegetable matter, falling into it, or washed in by rains. In this state it was probably a place of residence for the snails and myriapods and a trap and tomb for the reptiles; though

the presence of coprolitic matter would seem to show that in some instances at least the latter could exist for a time in their underground prison. The occurrence of so many skeletons, with a hundred or more specimens of land-snails and myriapods, in a cylinder only 15 inches in diameter proves that these creatures were by no means rare in the coal-forests; and the conditions of the tree with its air-breathing inhabitants implies that the Sigillarian forests were not so low and wet as we are apt to imagine.

The little land-shell, specimens of which with the mouth entire have now occurred to the author, is named by him *Pupa vetusta*. Dr. Dawson found entire shells of *Physa heterostropha* in the stomach of *Menobranchus lateralis*, and hence he supposes that the *Pupæ* may have been the food of the little reptiles the remains of which are associated with them.

Two examples of *Spirorbis carbonarius* also occurred; these may have been drifted into the hollow trunk whilst they were adherent to vegetable fragments. The Myriapod is named *Xylobius Sigillariæ*, and is regarded as being allied to *Iulus*.

The reptilian bones, scutes, and teeth referable to *Dendrerpeton Acadianum* bear out the supposition of its Labyrinthodont affinities. Those of the new genus, *Hylonomus*, established by Dr. Dawson on the other reptilian remains, indicate a type remote from *Archegosaurus* and *Labyrinthodon*, but in many respects approaching the Lacertians. The three species determined by the author are named *H. Lyellii*, *H. aciedentatus*, and *H. Wymani*.

4. "On the Occurrence of Footsteps of *Chirotherium* in the Upper Keuper of Warwickshire." By the Rev. P. B. Brodie, F.G.S.

True Chirotherian footsteps do not appear to have been hitherto met with in the Keuper of Warwickshire; but a specimen of Keuper sandstone showing the casts of a fore and a hind foot of *Chirotherium* was lately turned up by the plough at Whitley Green near Henley-in-Arden. The breadth of the fore-foot is about 2 inches; the hind-foot is $4\frac{1}{2}$ inches across. As the New Red sandstone of Cheshire, so well known for its fine Chirotherian foot-tracts, certainly belongs to the upper part of the New Red series, it may now be further correlated with the Upper Keuper of Warwickshire, the latter having yielded true Chirotherian foot-prints.

MISCELLANEOUS.

On the Mud-Fish of the Nile (Lepidosiren annectens?). By Dr. J. E. Gray, F.R.S. &c.

The British Museum has just received from M. Parzudaki of Paris two specimens of *Lepidosiren* from the "embouchure du Nil." They are much larger than any I have seen from West Africa. The largest is much bigger than the specimen which escaped from the small tank into the basin warmed with hot-water pipes in the Crystal Palace. One, in its dry, unstuffed state, is 32, and

the other 22 inches long. I have not been able to discover any difference between them and the specimen we have from Western Africa. The anterior filaments are very long: in the larger they are 9, in the smaller, 7 inches long, and evidently much contracted in drying.

Early Notice of the Tapaia *found in Pulo Condore.* By Dr. J. E. Gray, F.R.S. &c.

In Mr. W. Ellis's drawing (now in the Banksian Library at the British Museum) of the animals observed during Cook's third voyage, there is a figure and description of a species of *Tapaia*, marked as coming from Pulo Condore. In the MS. which accompanies the drawing it is described as—

"*Sciurus* (*dissimilis*) auriculis rotundis, rostro elongato, dentibus primoribus 6.

Habitat in Insula Pulo Condore.

Statura *S. vulgaris*. Caput, dorsum, et cauda supra colore leporino: infra pallido-grisea. Dentes superiores duo breves rotundati obtusi, inferiores 4 longiores exserti cuneati acute!! Pedes pentadactyli. Cauda depressa longitudine corporis, supra et utrinq. pilis longis, infra brevibus tecta!! Mystaces breves."

According to his 'Authentic Narrative of a Voyage,' 8vo, 1782, vol. i. p. 337, they were at Pulo Condore on the 20th of January 1780.

I may here observe that Mr. Ellis, in his MS. now in the Banksian Library, proposed and characterized several genera of birds, fish, &c., which have since been published by other authors. But he appears to have been restrained from publishing them by the strong prejudice that then existed against making any addition to the genera allowed by Linnæus, though that author, in his various editions of his 'Systema,' constantly altered and added to the genera. This prejudice continued until a much later date: thus, Dr. Horsfield, in order to ensure the publication of his paper on Japanese Birds, was obliged to erase a considerable number of genera, which have since been universally adopted.

New British Species of Hydra.

To the Editors of the Annals of Natural History.

Gentlemen.—Only three species of *Hydra* (*H. viridis*, *H. fusca*, and *H. grisea*) have hitherto been found; or perhaps it would be safer to say, only three have been described in the works accessible to me; and I therefore think it not wholly superfluous to send you word that a fourth species exists, apparently in great abundance, in the ponds of Wimbledon Common. I have there found, besides the three species already known, a beautiful bright-red species, which I propose to call *Hydra rubra*. The colour differs in intensity in different states of the animal, being sometimes of a brick-dust hue, and sometimes very like the red *Dianthus*.

I thought this *Hydra* might possibly owe its colour to some peculiarity in the food it got in its pond; but, having kept many of them in different waters for several weeks, I find them not only retain their original hue, but give that hue to the offspring they so freely bud. Hence I conclude that it deserves a specific name as much—or, rather, as little—as the three other species.

I remain, Gentlemen,

Yours, &c,.

Dec. 5, 1859. G. H. Lewes.

[Dr. Gray seems to have found the same species (?) near the same place, between twenty and thirty years ago. (See Johnston's Brit. Zoophytes, 2nd edit. p. 123.) Dr. Gray says: "I have found a *bright-red* Hydra rather abundant on Putney Heath, near London. It does not differ much from the green one, except in colour."—Ed.]

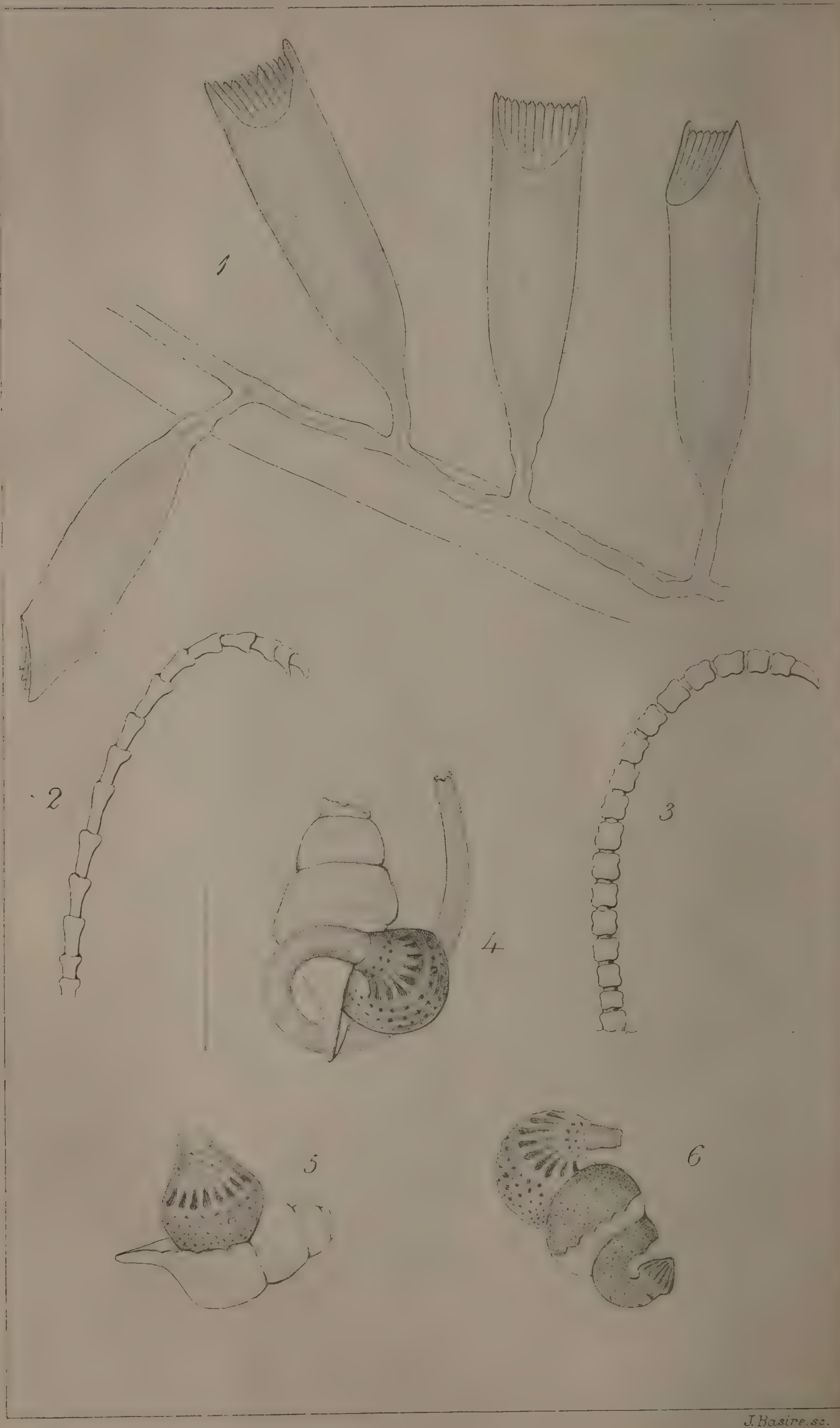
On a new species of Odontophorus. By John Gould, Esq., F.R.S., &c.

Two specimens of a fine species of *Odontophorus* having been placed in my hands by Mr. Sclater, for the purpose of comparing it with the other known members of the group, I beg to state that, after having done so with great care, I can come to no other conclusion than that it differs from the whole of them. It is most nearly allied to the *O. speciosus* of Tschudi, and the *O. hyperythrus*, Gould, but differs from the former in the much darker colouring of its upper surface, and in the rich rusty-red colouring of its forehead; it is also distinguished by having a broad band of the same colour surmounting the eye and extending to the nape of the neck, where it is met by a similar band, which commences at the base of the upper mandible, extends under the eye, through the ear, which feature has suggested the name of *erythrops* as its specific appellation. From the *O. hyperythrus* it differs in having a shorter and more obtuse bill, and in the well-defined black marking of the throat. The bird was discovered at Pallatanga in Ecuador, by Mr. Fraser.

Odontophorus erythrops.

Forehead, stripe over and another below the eye, extending beyond the ear-coverts, deep rust-red; crown of the head dark-brown; all the upper surface dark chocolate-brown, blotched and freckled with black; a small spot of buffy-white at the tip of each of the wing-coverts; throat and upper part of the neck jet-black: in the centre of this black mark, near its lower margin, a few of the feathers are snowy-white at the base, forming an indistinct lunar-shaped mark. Under surface, rich deep chestnut; feathers of the short tail and the primaries brownish black, the outer margins of the latter freckled with buff; thighs and under tail-coverts rayed transversely with black and lighter chestnut; bill black; feet blackish horn-colour.

Total length $10\frac{1}{4}$ inches, bill $\frac{7}{8}$, wing $5\frac{3}{4}$, tail $2\frac{1}{2}$, tarsi $1\frac{3}{4}$.—*Proc. Zool. Soc.* Feb. 8, 1859.



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THE ANNALS

AND

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[THIRD SERIES.]

No. 26. FEBRUARY 1860.

VII.—*Descriptions of a Zoophyte and two Species of* Echinodermata *new to Britain.* By Joshua Alder, Esq.

[With a Plate.]

The animals now described were obtained by George Barlee, Esq., during a dredging excursion to the Shetland Islands, in the summer of 1858. Mr. Barlee was so fortunate as to discover many new and interesting marine Invertebrata during his sojourn in those islands, the greater part of which belong to the class Polyzoa, and have been placed for description in the able hands of Professor Busk. The Molluscan rarities obtained have been already noticed in this Journal by Mr. Jeffreys. To complete the account of Mr. Barlee's discoveries, descriptions of the following species are now added.

Class ZOOPHYTA.

Family **Campanulariadæ.**

Campanularia fastigiata, n. sp.

Polypary with a smooth creeping stem, adhering closely to other Zoophytes. Cells large, oblong, tubular, gradually tapering below into a short pedicle, which is smooth and without rings; above, the cell rises into two opposite points, between which a plaited membrane on each side slopes over the aperture, forming an operculum with a medial ridge. Height of cell one-tenth of an inch.

On the stem of an *Eudendrium* from the inner Hauf, Shetland.

The nearest ally to this curious species is the *C. syringa,* from which it differs in its greater size and transparency, in the absence of rings on the pedicles, and in the cell's tapering

gradually into the latter at the base; but it differs more especially in the peculiar form of the operculum, which, when closed, slopes down on each side like the roof of a house, the two opposite angles forming the gables (Pl. V. fig. 1). When the operculum is fully open, the folds disappear, and the edges unite into a continuous rim round the top of the cell.

The description is taken from specimens preserved in fluid. The species belongs to the section of *Campanularia* which Mr. Hincks proposes to form into a new genus under the name of *Calicella* *.

Class ECHINODERMATA.

Order Crinoidea.

Comatula Sarsii.

Comatula mediterranea ?, Sars, Beskr. og Jagttagels.
Alecto Sarsii, Von Düben and Koren, Ofversigt af Skandinaviens Echinodermer, p. 3, tab. 6. f. 2.

One specimen of this little *Comatula* was obtained from deep water off the Hauf,—the first that has occurred in the British seas. The species was originally noticed by Professor Sars on the coast of Norway, and is fully described by MM. von Düben and Koren in their Monograph of the Scandinavian Echinodermata. It is smaller than the *Comatula rosacea* of Forbes, and more delicate and fragile in all its parts. One of the points most relied on for distinction is the character of the dorsal cirri, in which the joints are less numerous and more slender and elongated than in the other species, and are terminated by two claws (fig. 2), while those of *C. rosacea* have only one (fig. 3). There are also differences in the arms and pinnules. The colour of the individuals seen alive was light greyish brown.

Comatula Sarsii is a deep-water species, and appears to be very rare. The few specimens found on the Norwegian coast were dredged in depths varying from 50 to 100 fathoms. That got by Mr. Barlee was likewise found in deep water. It has been injured in the dredge; but enough remains to show the true character of the species.

The following is the diagnosis of this species given by Von Düben and Koren:—

"Cirrhis dorsum totum obtegentibus, sub 40, tenuibus, articulis 13–20, quorum longissimi (4–6) triplo longiores quam

* Among the Hydroid Zoophytes collected by Mr. Barlee was a fine specimen of *Grammaria ramosa*, of large size and very much branched. *Halecium labrosum*, *Sertularia alata*, *Plumularia halecioides*, *P. myriophyllum*, *Campanularia Hincksii*, and *C. gracillima* were also met with.

latiores; brachiorum syzygiis plerumque 4-articulatis; pinnulis sub 40, quarum intimæ 4–5 filiformes sequentibus multo longiores."

Family Sipunculidæ.

Phascolosoma radiata, n. sp.

Body vermiform, cylindrical, tapering a little posteriorly, and terminating in a conical button, which is longitudinally furrowed. The anterior part of the body is subconical and a little flattened above, where it is marked with radiating furrows, above and below which it is coarsely granulated, the granules becoming finer on the remaining part of the body. The proboscis is very long, delicately ringed or transversely striated, and terminating in a smooth aperture without tentacular filaments. The upper portion of the proboscis is transparent and flesh-coloured; the lower more opake and yellowish. The body is yellowish, spotted and streaked with dark brown on the more prominent parts. Length of body 2 inches; proboscis nearly the same.

Mr. Barlee got a single specimen of this fine species from deep water, which he kindly sent me alive. It occupied a broken shell of *Aporrhais pes-pelecani*, from which the fore part of the body protruded considerably. It threw out its proboscis to a great length in search of food, generally holding it in a curved or spiral position.

The genus *Phascolosoma* was constituted by Leuckart, in his 'Breves Animalium Descriptiones, &c.,' and appears to differ from *Sipunculus* principally in the absence of the circle of feelers round the mouth; but the genera of the *Sipunculidæ* are very badly defined, and will require revision when the species are better known. At present very few of them are described.

The *Phascolosoma longicolle* of Rüppell, found inhabiting corals in the Red Sea, has considerable resemblance to our species, but is evidently distinct.

EXPLANATION OF PLATE V.

Fig. 1. *Campanularia fastigiata*, highly magnified.
Fig. 2. One of the dorsal cirri of *Comatula Sarsii*, magnified.
Fig. 3. Do. do. *Comatula rosacea*, magnified.
Fig. 4. *Phascolosoma radiata*, with the proboscis extended (the line shows the natural size).
Fig. 5. The same, with the proboscis retracted.
Fig. 6. The same, with the shell partially broken away, to show the posterior extremity.

VIII.—*On the Tribe* Colletieæ, *with some Observations on the Structure of the Seed in the Family of the* Rhamnaceæ. By John Miers, F.R.S., F.L.S. &c.

This tribe differs from others of the *Rhamnaceæ* in having always opposite branchlets usually terminating in acute spines, while in most Rhamnaceous genera they are alternate; for, though they sometimes approximate in pairs, they are never exactly opposite: the same may be said of their leaves. The *Colletieæ* also differ in the position of their petals and stamens, their insertion being always perigynous upon the tube of the calyx at some distance from the hypogynous disk, which in *Colletia* assumes a perigynous form: in this respect we meet with only one exception, in *Adolphia*, where, owing to the extreme shortness of the calycine tube, their point of attachment is drawn close to the disk; but, although thus brought into proximity, they are not actually inserted upon its margin, as they are generally in the *Rhamneæ*. In the tribe *Gouanieæ*, so different in most other respects, the insertion of the petals and stamens is like that of the *Colletieæ*. The stamens are placed opposite to as many scale-like petals in all the *Rhamnaceæ*; they are generally concealed and hooded by them in the *Colletieæ*, and are inserted upon their claws, between the lobes of the calycine border; the petals are, however, sometimes wanting, and in a single apetalous species the insertion of the stamens is below the middle of the tube. The *Colletieæ*, besides, are generally distinguishable at a glance by their peculiar habit: the branchlets, half abortive, often assume the form of spines, which are either quite bare, or they are foliiferous, or else they become more elongated, bearing both leaves and flowers, but sometimes they are destitute of both, with a broom-like appearance; the leaves, when present, are always small and opposite, or, by the approximation of the axils, almost fasciculated, and are either entire or denticulated, and sometimes are reduced to almost obsolete proportions. Most of the species at present known are natives of South America; there are a few in Mexico, one from the Galapagos, one from the island of Juan Fernandez, one from Australia and Tasmania, and another from New Zealand. There has hitherto been much confusion among the genera, the characters of many of them being still undefined: thus *Trevoa* and *Talguenea*, which I proposed above thirty years ago, have been confounded together by most botanists. My observations, I hope, will enable me to define the characters and limits of these as well as the other genera of the tribe.

When Jussieu published his 'Genera Plantarum' (in 1789), the only genus then known of the present tribe was *Colletia*; it

was there placed in his order *Rhamni*, a heterogeneous group composed of *Rhamnaceæ, Celastraceæ, Aquifoliaceæ, Bruniaceæ, Staphylaceæ,* and some other genera. From this association Mr. Brown (in 1814) separated the *Celastraceæ*, including the *Aquifoliaceæ*, and (in 1818) the *Bruniaceæ*; and thus circumscribed, DeCandolle (in 1825) published an enumeration of the order, wherein *Colletia* appears as the only genus belonging to the tribe since constituted. We owe to Brongniart (in 1826) the best monograph of the family that has yet been published, where its affinities are well discussed, and where ample characters of the genera are given: here he first separated *Retanilla* from *Colletia*, and at that time he was able to muster only seven species in these two genera. Subsequently to that period, the number of plants belonging to the *Rhamnaceæ* have become greatly multiplied, and the characters of the species better known; several new genera have been established, but no regular enumeration has appeared since that of Brongniart above mentioned, so that a proper monograph of the order has become a great desideratum. It seems that Reissek (in 1840) was engaged in this important task; but his promised monograph, after a lapse of twenty years, has not yet made its appearance. Endlicher, in the same year, however, adopted the arrangement of Reissek, and accordingly, in his 'Genera Plantarum,' divided the family into six tribes, the *Colletieæ* being one of them, which there comprehends six genera.

Before I proceed to arrange my own observations, I will offer a few prefatory remarks upon many points of structure that I have met with in this family, and which do not appear to have been noticed. These developments I have found in all the species of the *Colletieæ* that have come under my scrutiny; they are constant in the *Gouanieæ*, and have been observed in many genera of the *Rhamneæ*; but I have not attempted a general examination of the whole order, as this required more time than could be devoted to it, and would have drawn my attention from other investigations in which I have been long engaged.

The fruit in all the genera of the *Colletieæ* is polycarpous, the normal number of its cells being three, rarely four: these are sometimes reduced to two, even in the ovary; and if the fruit be occasionally monospermous, as often occurs in *Trevoa, Colletia,* &c., the vestige of each abortive cell is always distinctly visible. The ovules are invariably solitary in each carpel, always erect, and fixed in the bottom of each cell; the radicle of the embryo constantly points to the hilum.

The seeds throughout the whole tribe of the *Colletieæ* present the same features; and as there are many curious circumstances

connected with their structure, those of *Colletia dumosa*, collected by me in Chile thirty-five years ago, are selected as an example. They are of an oval form, about $1\frac{1}{2}$ line long, 1 line in diameter, sometimes slightly compressed, often with an obsolete ridge on the ventral face, which has been mistaken for a raphe; erect; with a very hard polished outer surface, appearing finely granulated when magnified: this outer coating is corneous in texture, becoming softer by long maceration, when it may be cut through with a sharp knife; it is somewhat translucent, but rendered densely black by the lining that adheres to it; at its base, in a transverse direction in regard to the fruit, is seen a long furrow, or compressed bilabiate slit, which is always pervious. This outer shell is uniform in thickness, homogeneous in texture throughout, and under the microscope is seen to be composed of numerous narrow, transverse, hyaline cylinders, apparently solid, of equal size, all placed in a direction radiating from the centre of the seed; so that when the shell is viewed through either of its faces, it appears like a reticulation of minute hexagonal cells, each cell corresponding to the end of a long cylinder: these cylinders, by long maceration, may be separated from each other; it is clear, therefore, that in this organization there is not the slightest approach to any longitudinal vascular continuity. For reasons to be shown presently, we may infer that this shell is not one of the ordinary integuments developed from any of the original tunics of the ovule, but of posterior growth, and therefore not a testa, as hitherto supposed: it is a production apparently analogous in its structure to the outer tunic formerly described in the seeds of *Cucurbitaceæ**.

* Trans. Linn. Soc. xxii. 92 & 108. More extended observations upon the seeds of different *Cucurbitaceæ* have led me to modify the inference made in that stage of the inquiry (*loc. cit.*), that the more external covering (there described as formed of three several portions) consists of epiderm, mesoderm, and endoderm—terms incorrectly applied to parts evidently distinct in their origin. The outer very thin stratum of that fleshy covering is reticulated with long hexagonoid cells, and its origin may be traced to an extension of the outer membrane of the funicle; the intermediate soft substance is a collection of lax fleshy cells intermixed with numerous araneiform filaments, all probably emanating from the fleshy substance of the funicle. In many genera this fleshy parenchymatous substance is entirely wanting, so that the shell of the seed is covered simply by the above-mentioned thin pellicular membrane. In the centre of the funicle a thick cord of vessels is seen, which, as it approaches the seed, is observed to bend towards one side, and to enter one of the ends of the linear basal slit of the hard tunic; there is no appearance of its bifurcation at that point, as the vessels of the funicle appear to be immediately connected with only one of the two extremities of the peripherical raphe, which meet together in the base of that tunic. This hard crustaceous shell, usually called the testa, presents no sign of any organic connexion with the two layers of structure before mentioned, nor with the more internal tunic. The exist-

Within this shell, and adhering to it, is a second tunic, which is membranaceous, and agglutinated to it by means of a thick layer of cellular deposit of spongiose texture, brittle when dry, and so loosely aggregated that, when removed and soaked in water, and then slightly touched, these cells separate into distinct globules of a hexagonoid shape, and of a deep crimson colour. In the substance of this second membranaceous tunic is observed a white cord, which rises from the bottom, originating in one of the angles of the basal pervious chink, runs up one side of the tunic, crosses its summit without interruption in its course, and passes down the contrary side, terminating in the opposite corner of the basal perforation, and thus making a complete peripherical circuit round the inner surface that lines the shell. This cord is composed of a number of delicate spiral threads, so free that each fibre is easily drawn out separately. In some genera of the *Rhamnaceæ* (as in *Zizyphus, Alphitonia*, &c.), this second tunic is perfectly free from the outer corneous shell, a considerable space existing between them, in which is generally found a small quantity of very lax white cellular tissue. A third integument, although free from it, fills the space in the upper moiety of the last-mentioned coating in *Colletia*, but a little below the middle it becomes gradually narrower, more opake, and of a thicker texture, until it tapers into a short stout thread, that terminates in the basal perforation of the outer shell. The opposite extremity, or summit, is marked with a dark fleshy disk, like a chalaza, of nearly its own diameter. These integuments closely invest the albumen, which is fleshy, homogeneous in texture, and of considerable thickness on the ventral and dorsal faces, but becomes very thin round the margins of the cotyledons, the whole mass being of a roundish oval shape, suddenly contracted at its base into a prominent nipple, which is enclosed within the rostellated neck of the investing integuments before described; the embryo is nearly the size of the albumen, and much flattened, the cotyledons being oval, foliaceous, and fleshy, slightly cordate at the base, where they are united by a short cylindrical radicle,

ence of a small thickening or chalazal spot on the summit of the inner integument, and of another round its contracted basal neck, are constant in all the seeds I have examined. The raphe is invariably peripherical, and undisturbed in its course by the apical chalaza, which it crosses: it is also free from the shell in all parts, except at its two basal extremities, which are both imbedded in channels formed in the crustaceous thickening of the shell around its base; but one of these extremities only, as just said, appears to be a continuation of the cord of the funicle. The imbedding of the two extremities of the raphe in a crustaceous deposit in the base of the shell is analogous to the structure observed in many genera of the *Rhamnaceæ*.

one half of which lies within the sinus, the other half in the nipple of the albumen; the cotyledons are anterior and posterior in regard to the axis of the fruit.

The presence of the distinct external crustaceous shell, always more or less pervious at the basal extremity (or one of its sides), and the position of the raphe, as above described, attached to an intermediate integument, making nearly a complete circle round the seed,—are features that occur not only in all the *Colletieæ*, but in all the genera of the *Rhamnaceæ* that I have examined, though subject to several modifications, which I will mention. In *Rhamnus catharticus*, however, as well as in *R. Alaternus* and a few others, the raphe, though still peripherical, is differently situated, for it is everted yet further from the position mentioned in *Colletia*; it is seen upon the dorsal face of the seed,—a well-known occurrence, that has been ingeniously accounted for by Mr. Bennett*; but before we adopt his conclusion, it is desirable to investigate the circumstances attendant on the phænomenon. Mr. Bennett says that he has universally found, throughout all *Rhamnaceæ*, that the ovules, in their early state, uniformly exhibit a ventral raphe; and hence he infers that any variation subsequently observed in its relative position, whether it be shifted to one side or round to the dorsal face, must be due to a simple twisting of the funicle, by which the ovule is turned upon its axis, either to the extent of a quarter or of half a revolution. Were this explanation required only in the case of the raphe becoming dorsal, we could scarcely refuse our assent to it, because in that case it appears to solve the difficulty with apparent satisfaction, notwithstanding that Mr. Bennett confesses his inability to assign any cause for so singular a rotation of the ovule.

The first point to be considered is the soundness of the foundation of the argument, that at the period of its fertilization the ovule has its raphe directed to the ventral side, and that it subsequently turns away from it by a lateral torsion of its funicle. Mr. Bennett states (*loc. cit.* p. 131) that he has invariably found this to be the case in the *Rhamnaceæ*; and this statement has been accepted as an indisputable fact by nearly all botanists. Some few, however, have ventured to cast a doubt on the subject: Mr. Clarke† says he has always found the raphe dorsal or lateral in that family from an early period; while Prof. Agardh affirms the reality of this latter circumstance, and protests in positive terms against the prevalent belief on this subject ‡; in his work above referred to, he gives a figure as an example of

* Plant. Jav. rar. 131.
† Linn. Proceed. ii. 148–150; Ann. Nat. Hist. ser. 2. xi. p. 85.
‡ Theor. Syst. Plant. p. 178, and plate 15. fig. 5.

the structure (plate 15. fig. 5) where the raphe is turned away from the axis of the ovary prior to its impregnation. My own observations upon this point, though limited, certainly favour the latter view; for I have found, in repeated examples of *Rhamnus chlorophorus* where the raphe in the ripe seed is half lateral, half dorsal, that, in its unimpregnated ovule, it occupies exactly the same position: had there been any previous pivoting round upon its funicle in this case, the micropyle would have been turned away from the point necessary to its fertilization, and the funicle would consequently have intervened between the foramen of the ovule and the impregnating point protruding from the placenta; but I found, on the contrary, that the micropyle is placed over the fascicle of stigmatic tissue, evidently in its normal and proper position. Another confirmation of the same view occurs in *Rhamnus Alaternus*, where, in the ripe seed, the raphe is exactly dorsal, as in *R. catharticus*: here I found the unimpregnated ovule having its raphe precisely in the same position as in the seed, with its micropyle placed over the impregnating point of the placenta, and situated between the funicle and the axis of the ovary, proving that in this case there had been no twisting of the funicle, and consequently no pivoting of the ovule. I have also examined the living ovary of *Rhamnus catharticus* in an extremely young state, long before the ripening of the anthers, and therefore prior to its impregnation, and I have found the raphe most distinctly upon the dorsal face, precisely in the same position which it occupies in the ripe seed. All the evidence that I have thus been able to collect tends therefore to subvert Mr. Bennett's hypothesis. On the other hand, the explanation I have offered on a former occasion *, of the cause of a dorsal or lateral raphe occurring, as I believe it does, universally throughout the *Rhamnaceæ*, appears to me quite satisfactory: here, from a most simple and natural cause, originating either in the epipylar or allopylar pullulation of the nascent development from the basal placenta, we have the ovule either with a dorsal or lateral raphe; and, where dorsal, it is forced into that averse position by the mere act of the resupination of the ovule owing to the pressure of its growth against the base of the cell, in the manner first sagaciously suggested by Mr. Brown in the case of *Euonymus*. Had the same epipylar pullulation originated out of a higher point of the axis of the ovary, we should have seen in that case a pendent ovule with a ventral raphe, as occurs in the neighbouring family of the *Celastraceæ*, where in the same cell, from the cause here assigned, we sometimes meet with ovules, some with a ventral and others with a dorsal raphe.

* Ann. Nat. Hist. 3 ser. iv. 25.

I will now advert to the other anomalous fact, in regard to the raphe, above alluded to. Botanists have always attributed to the seed of *Rhamnus* a chartaceous testa, with a raphe as a simple cord, that runs up its external face, or along one side, in a deep groove formed by a conduplicature of the whole seed, and then terminates in the apical chalaza; but one important circumstance connected with this structure has been altogether overlooked. I have found that this cord has a peripherical range similar to that in *Colletia*, with this difference, that instead of running laterally round it in the line of the margins of the cotyledons, it is directed along the middle of one cotyledon, in a deep groove upon the dorsal side, then crosses over the chalaza without any apparent interruption in its course, and returns down the ventral side in a direction close to the median line of the other cotyledon, till it again reaches the hilum.

As this structure is at variance with recorded descriptions, it is necessary to state the circumstances more in detail. My first observations were made upon the dried seeds of *Rhamnus catharticus*: this seed is smooth, of a hepatic brown colour, and of a flattish oval shape, somewhat tapering to the base, where it is callous and more polished; it is a little angular upon the ventral face, and rounded upon the dorsal side, along which is seen a line running from the apex to the base: on pressing it, this line is found to be the margin of a deep chink, which extends all the way down to the axis of the seed. If we carefully remove the outer coating, we find it rather thin, very brittle, and crustaceous, thus exposing a second tunic, which is very fine in texture, membranaceous, and polished, and upon its ventral side, opposite to the dorsal chink, is seen a distinct line running from the base to the apex, where it passes over a large areolar disk, and runs into the summit of the chink in continuity with the main cord of the raphe. If we take another seed, and cut it in two transversely, we see the outer brittle tunic just mentioned becoming somewhat thicker as it approaches the dorsal chink, where it is continued by induplication, in the form of two rather thick crustaceous plates that line the sides of the chink, the internal edges of these plates being quite disconnected with each other: it is evident, therefore, that this outer covering is not an entire tunic; for if it were unfolded, it would be found to be merely a thin plate with thick margins, which are introflected in the manner described. In the bottom of the chink, which widens towards the axis, is seen a thin membranaceous diaphragm, that forms one side of a square hollow cavity which runs through the axis from the apex to the base, and which diaphragm is found to be a portion of the second thin polished membranaceous tunic before mentioned, that lies beneath the

outer crustaceous covering; and upon this diaphragm is observed the thick cord described by botanists as the dorsal raphe, which rises from the base, crosses the disk-like areole in the summit, and runs down the opposite side of the seed, forming the line first described as seen on the ventral face. The whole of this intermediate integument, with its entire raphe, may be exposed to view if we chip away in small fragments the outer crustaceous coating with the point of a knife, when the two cords, both ventral and dorsal, are distinctly seen; the two teguments are closely adpressed upon each other, except over the ventral cord, where there is always a considerable interval between them, thus showing that the raphe has no connexion whatever with the outer crustaceous coating. Beneath the second envelope is a third integument, which immediately invests the albumen, and which is thin and membranaceous; these two integuments, though free, are in immediate contiguity at all parts of their surface, except along the middle of the dorsal face, where they become separated to form the square hollow channel in the axis abovementioned, one side of which square, with the imbedded raphe, is formed by the induplicature of the intermediate integument. The embryo is broad and foliaceous, and is covered by a layer of fleshy albumen, equal in thickness to the cotyledons,—the margins of the whole, together with the enveloping tunics, being conduplicated into the hippocrepical form at first described. We see here, therefore, the existence of three seminal envelopes, very similar in their nature to those described in *Colletia*, with this remarkable difference, that in the latter the crustaceous coating is entire, while in *Rhamnus* it is always incomplete upon one side. In *Rhamnus catharticus* the groove formed by the conduplication of the seed is generally in the middle of the dorsal face, though sometimes nearly lateral, caused by unequal growth, in consequence of the partial abortion of one of the carpels; but in all these cases, the two lines of raphe always correspond with the middle of the cotyledons, while in the *Colletieæ* they constantly run along their margins*.

The same structure exists in *Rhamnus Alaternus*; but on account of the small size of its seeds, and the greater tenuity of the several integuments, it requires much care to dissect the parts. The crustaceous covering is very thin, and adheres more firmly to the extremely delicate intermediate integument, and it is therefore difficult to separate them without lacerating the latter; but when the separation is made with care, we find the ventral portion of the cord imbedded like a white line in that distinct integument, and running from the apex to the base:

* Analytical details of this structure in *Rhamnus catharticus* will be shown in plate 33 A of the 'Contributions to Botany.

the dorsal groove is more shallow, and embraces the other corresponding portion of the raphe and integument, so that, on detaching the external crust, the raphe comes away with it, tearing itself from the rest of the integument*.

This structure is repeated, under somewhat varied circumcumstances, in *Rhamnus chlorophorus*, Dcne. : here, however, the raphe is lateral, not dorsal; the cotyledons are not involutely inflected, as in the former case, but are simply complicated or folded upon one another, so that their midribs stand opposite one margin of the seed, while all the four edges of the two cotyledons face the contrary margin, the albumen and integuments partaking of the same complicature. A deep groove is thus formed, reaching to the axis, as in *R. catharticus*, which here is therefore lateral, instead of dorsal; the raphe does not lie in the bottom of the deep groove, as in the latter species, but as it leaves the chalaza it runs along the mouth of the groove from top to bottom, as in *R. Alaternus*, and the middle integument, to which it is attached, here makes a deep plicature which nearly reaches the bottom of the groove; and throughout the whole length of this plicature it is separated on both sides, by a vacant interval, from the inner integument, thus forming a kind of loose, incomplete partition all down the groove. This intermediate tunic is membranaceous, and invests all other parts of the seed; it is enclosed within an external, hard, polished, testaceous covering, similar in texture and appearance to that in *R. catharticus*, but it is not, as in that species, inflected into the groove: the groove is here rather an open slit, always on the sinister margin (looking from the axis of the fruit), and is surrounded by a thick callous rim, which, rising from the basal and hilar point of attachment of the seed, extends upwards to one-third or half its length. This crustaceous coating lies close upon the intermediate integument of the seed over its two broad faces; but at its summit, and all along the other margin (opposite to that of the groove), a vacant space intervenes between them. The raphe is imbedded in that intermediate integument in the form of a simple cord, the thicker moiety of which runs along the base of the groove, and is free from it at all points, except at the bottom of the groove, where it adheres to it by means of a crustaceous deposit: it continues its course in a peripherical direction, crossing the apical chalaza beneath the free space mentioned, and runs down along the opposite margin of the seed, till it again reaches the pointed base or micropylar extremity of the inner integument. I have frequently succeeded in detaching the entire raphe with a portion of the integument

* This structure will also be given in detail in plate 33 c of the 'Contributions to Botany.'

in which it is imbedded (even from over the chalaza), when it thus appears in one unbroken peripherical band, containing spiral vessels: this separation of the raphe may be effected without disturbing the under or more internal integument, showing that it has no adhesion to it*.

A very similar structure is found in *Rhamnus utilis*, Dcne.: here the embryo, the albumen, and the two integuments, are folded on one another exactly as in *R. chlorophorus*, the groove being, in like manner, constantly on the same sinister margin; the testa also shows, on the dexter margin of the seed, a similar continuous cord of the raphe; but the intermediate integument, in its plicature within the groove, adheres on both sides to the inner tunic, till it arrives nearly at the bottom of the channel, where it suddenly separates from it, and crosses the groove in form of a diaphragm, leaving a vacant square space in the axis, formed by a separation of the integuments, which extends from the apex to the base, and upon this diaphragm is distinctly seen the main cord of the raphe,—an organization similar to to that of *R. catharticus*. The outer coating is of the same form as in *R. chlorophorus*, but of a different texture; it has the same longitudinal open slit along the lower half of the sinister margin, but its edges are more or less inflected into the groove. Its texture is not crustaceous, but consists of a thick simple membrane, invested with a number of compact long yellow cells, disposed horizontally, and aggregated into a lax spongiose covering, which sometimes partially adheres to the endocarp.

In *Frangula vulgaris* the structure is different from that of *Rhamnus*, even when the raphe is lateral, as I have shown it to be sometimes, in the latter genus. The seed is nearly orbicular and much flattened; the crustaceous covering is as thin and delicate as in *Zizyphus*, but its basal foramen is much larger, rounder, and more open, with two thick callous lips placed right and left of the axis, not anterior and posterior, as in that genus and in *Colletia*. Beneath it, and lying between it and the intermediate integument, there is a deposit like charred paper, which in most parts adheres to the external crust, but is separable from it, as in *Colletia*. On removing this, we find the very delicate intermediate membranaceous integument conical towards the base, where it terminates in a hooked thread, as in *Colletia*, and from which, right and left, along each margin, is seen a thick white cord, both arms being joined in one peripherical line over the apical chalaza. It will be remarked that, upon the sinister side looking from the

* Complete details of this organization will be given in plate 33 B of the 'Contributions to Botany.'

axis, the cord is thicker and enveloped in a yellowish incrustation, which, for one-third the length of the seed, there adheres to the outer crustaceous coating, as was observed in *Rhamnus chlorophorus*. The embryo is perfectly flat; the cotyledons very thin and foliaceous, enclosed in an albumen of equal thickness; the two internal integuments are of extreme tenuity, and on that account are not easily separated. This organization, it will be seen, greatly resembles that of *Zizyphus**.

In *Zizyphus*, I find the course of the raphe also peripherical, but it runs along the lateral edges opposite the margins of the cotyledons, as in the *Colletieæ*; and we find here some points of structure deserving of being recorded. The outer corneous covering of the seed is entire, as in the *Colletieæ*, but much thinner in texture, and more translucent. This coating is of a more compressed form, tapering towards the base, which is polished and somewhat tumescent, and which has a basal chink similar to that of the *Colletieæ*, through which the nourishing vessels of the raphe pass from the placenta. It may here be observed, that in the bottom of each cell of the nut is seen a small fleshy cup, with a crenulate raised border, within which the seed is seated, and across the bottom of this cup is a white raised line, corresponding to the hollow in the basal chink of the seed; but the margins of this chink and the tumid base of the external coating are highly polished, and the latter shows no sign of any organic connexion with the cup: the hilar point of attachment is therefore confined to the mere cord of vessels proceeding from the placenta to the raphe. The second tunic, which is very thin and membranaceous, does not quite fill the cavity of the outer shell; it is more conical at its base, where it terminates in a short thread that issues through the chink above mentioned; the space between it and the outer shell is filled with a quantity of very lax white cellular tissue; it is pyriform in shape, much compressed, and tapers into a short cord at its base, which is seen to divide itself into two prominent threads that run along the margins of the tunic, and meet over a large fleshy chalaza-like disk in the apex, in one uninterrupted line: this cord of vessels is therefore completely peripherical, as in *Colletia*. This second tunic is quite free from a third, inner integument, which is thicker and more opaque, and which invests a very thin fleshy albumen: this third integument is sensibly shorter, and more conical at its base, where it terminates in a dark areolar neck, and tapers into a short suspensor-like thread, which is embraced by the neck of the second tunic. These two integuments are easily separable from one another by the introduction of a needle

* This structure will be fully shown in plate 33 D of the 'Contributions to Botany.'

between them, except round the margin of the apical chalazal disk, where they appear to be intimately agglutinated; the embryo is flat and compressed, its foliaceous cotyledons being parallel with the partition of the nut, and their margins contiguous to the peripherical cord of the raphe. This organization* is more evidently seen in this instance, as the seed is six times longer than that of *Colletia*, which it greatly resembles in structure: it is also remarkable for exhibiting many points analogous to the organization I have described in the seeds of *Cucurbitaceæ*†.

This singular extension and displacement of the raphe, accompanied by the formation of an extraneous crustaceous covering in the seed, was not altogether a novel fact, as I thought when I first remarked it in the *Cucurbitaceæ*; for the occurrence was partly noticed thirty years ago, in *Rhamnus*, by Brongniart, who, strangely enough, was not struck by the appearance of so remarkable a phænomenon, which he passed over without comment, and it has remained unnoticed by other botanists since that time. Brongniart's words are worthy of being quoted, as showing a notable correspondence with my observations. Alluding to the *Rhamnaceæ*, he says ‡: "Dans toutes ces plantes, le test lui-même, examiné au microscope sur des ovules déjà fécondés et à moitié de leur développement, est composé de trois couches très différentes; l'une, externe, n'est qu'un epidermis mince §; l'autre, moyenne, est solide et fibreuse, formée de fibres ou cellules alongées transversales, c'est elle qui doit former le test de la graine; enfin l'interne, très épaisse dans les premiers temps qui suivent la fécondation, est formée de parenchyme lâche, composé de cellules remplies de globules verts; elle s'atrophie, peu-à-peu, à mesure que l'amande et l'embryon se développent. C'est en général dans cette couche que passent les vaisseaux nourriciers, qui composent le raphé, et vont former la chalaze, raphé qui dans ce cas, suit l'un des côtés de l'ovule en dedans du test, et *redescend en partie de l'autre côté*, après que la plupart des vaisseaux qui le composent, ont donnés naissance par leur épanouissement à la chalaze." The latter conclusion appears, however, to have been only conjectural ||.

The entire peripherical circuit of the tracheal vessels in one

* Drawings of this analysis will be given in plate 33 E of the 'Contributions to Botany.'

† Linn. Trans. xxii. 92.

‡ Ann. Sc. Nat. x. 340.

§ This is a thin layer of cellular tissue that invariably lines the epicarp, and partially adheres to the outer crustaceous coating of the seed in *Rhamnus*, and which I have not considered necessary to mention in the preceding description.

|| "La chalaze vasculaire m'a toujours paru formée entièrement par une épanouissement des vraies trachées: elle est formée extérieurement par une expansion des vaisseaux du raphé" (*l. c.* p. 341).

of the integuments of the seed, which I have invariably found in one unbroken continuity, was therefore not fully traced by that eminent botanist, although it is evident, from the above quotation, that he had noticed the return of the raphe over the chalaza, and its partial descent down the contrary face of the seed. It is strange that this remarkable and novel feature was not afterwards alluded to, and that the mention of this extension of the tracheal vessels is omitted in the very copious diagnosis he gives of the order, where every other circumstance connected with the structure is carefully enumerated.

Some indications, leading to a knowledge of the origin of the external crustaceous envelope of the seed in *Rhamnaceæ* may probably be drawn from Brongniart's valuable memoir above quoted, in which he records the changes which he observed during the periods of the impregnation and growth of the ovule in that family. These details were published in 1827, a year or two prior to the appearance of Mirbel's two celebrated memoirs on the development of the vegetable ovule, and before the modern nomenclature of the parts of the ovule and seed was adopted. I will therefore briefly recapitulate such of his observations as bear upon the subject under consideration. He noticed* that the stigmatic tissue terminated in a small cellular protuberance (since denominated the "telæ conductrices") in the inner angle of the cell of the ovary, close to the foramen of the anatropous ovule; and he remarked the condition under which the latter became fecundated: the ovule is always supported upon a somewhat elongated funicle filled with nourishing vessels, and surrounded by loose cellular tissue; this funicle, which is very contracted before impregnation, begins to swell from the moment that the stigma has received its fertilizing influence; it afterwards expands and extends itself over the foramen of the ovular tunic. Brongniart, who first traced the expansion of the boyaux of the pollen-grains, and their passage down the stigmatic channels†, was not then aware of their ultimate extension through the prominence he observed at the termination of those channels; nor did he notice the continuity of one of these boyaux with the minute thread which he had remarked in connexion with the embryo-sac, and which he considered to be an emanation from its neck: according to the notion he then entertained, he concluded that the act of impregnation was conveyed through the agency of the cellular tissue of the umbilical cord‡, which the fact he recorded of the swell-

* Ann. Sc. Nat. x. 340.

† Ib. xii. 152 & 256; read before the Academy Dec. 26, 1826.

‡ Ann. Sc. Nat. x. 343: "Et c'est par l'intermédiaire de ce tissu cellulaire du cordon ombilical que je pense que s'opère l'impregnation de

ing of the funicular support, and its subsequent extension over the coats of the ovule, seemed to support. I now call attention to this last-mentioned circumstance, because it may serve to explain some essential points of structure in the seeds of the *Rhamnaceæ*, and may enable us to trace the source of the external tunic of the seed, which, on account of its crustaceous or corneous texture, has been mistaken for the testa, but which is evidently of a different nature and origin.

I will also record some circumstances observed by me that may tend to throw some additional light upon the nature of this development. We very often find, in the fruits of *Rhamnaceæ*, that one of the carpels is sterile; here generally the abortive coccus grows nearly to its full size, but it is quite flattened, with its line of dehiscence, as usual, along the middle of the ventral face; in such carpels we always meet with a persistent unimpregnated ovule, standing upon its long funicle. In *Rhamnus chlorophorus*, for example, the sterile coccus is orbicular, and $1\frac{1}{4}$ line in diameter; the length of the ovule with its funicle is $\frac{5}{8}$ line; it is erect; the foramen of the primine is distinctly open, and points downward, the tunic itself showing yet no indication of any plicature; the secundine, seen through the primine is shorter and smaller; and the nucleus is much narrowed, being scarcely half the length of the primine; while the chalaza is clearly visible in the summit, and also the thick distinct opake line of the raphe extending into it from the funicle. The position of the raphe, in this ovule, exactly corresponds with its place and direction in the ripe seed, showing, as I have before indicated (p. 81), that its situation, which has been considered abnormal in the seed, is not due to any twisting of the funicle, or to any disturbance caused by the subsequent plicature of the different parts of the ovule; and this we find to be further proved by the presence of the "telæ conductrices" immediately beneath the foramen of the primine, which would not happen had the ovule been forced round into this position by the torsion of its umbilical cord. I have found, in the several instances examined, the main line of the raphe and funicle constantly in one and the same position upon the dorsal face, everted more than the quarter of a circle (140°) from the point of zero, starting from the axial line of the fruit: from the chalazal summit, and down the contrary or ventral face of the primine, is seen a second cord, corresponding in position with the ventral raphe of the seed, and running from the summit to the mouth of the tunic. In one

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l'ovule,"—an opinion which he soon renounced after his subsequent important investigations into the growth of the ovule: Ann. Sc. Nat. xii. chap. p. 242.

instance I traced the existence of spiral vessels for more than half the length of this cord; in another they were visible nearly as far as the foramen, but the dorsal cord was too opake to allow them to be detected, although their presence there cannot be doubted. The stipitate funicle was about a quarter of the length of the primine, and was covered with a number of elongated transparent cells, apparently in progress of extension, in the manner observed by Brongniart, as above quoted; and to their growth and expansion we may probably look for the origin of the crustaceous coating of the seed.

I have noticed precisely the same facts in *Rhamnus Alaternus*, where the raphe is strictly dorsal, as in *R. catharticus*; in one instance I observed that the coats of the ovule had become quite opake, the mouth of the primine being closed by a tumid expansion over it, and that this expansion embraced the long funicle, which had nearly disappeared: we may thus account for the total absence of any funicle in the ripe seed. I will not aver that this evidence is complete; but the disappearance of the funicle and the production of a distinct extraneous coating over the ovule, to whatever cause they may be owing, are most evident facts. There is much probability that this crustaceous coating derives its origin from the growth and expansion of the funicular support,—a growth first noticed by Brongniart, and apparently confirmed by what I have seen and recorded above. To this cause we may attribute the production of the vacant space that exists in the seed between the membranaceous integuments and the lower portion of the crustaceous coating, and also the appearance of the suspensor-like thread in which the base of the two membranaceous integuments terminates; for Brongniart recounts that, after impregnation, he found the mouth of the secundine embraced by the neck of the primine, just as I have described the appearance in the basal extremity of the two inner integuments of the seed of *Zizyphus*.

There exists in some instances yet another production over the seed, still more external than the crustaceous coating, the mention of which I have delayed till now. This expansion, which seems to proceed from the placentary point of attachment of the funicle, shows itself in a rudimentary state in *Zizyphus*, as I have before described it, under the form of a small free cup with a crenulated margin, which remains fixed to the pericarp, and in which the sessile seed reposes: this seems to be a constant feature in that genus. In *Phylica* and its congeners the seed is affixed in a stipitate cup that remains attached to it; this is fleshy, generally four-toothed on the margin, but in one genus is deeply cleft into ten radiating lobes.

In *Alphitonia* it assumes its fullest development, appearing as

a thin, dark-coloured, brittle, submembranaceous, loose envelope, open at the top and sometimes also along the dorsal face; but in all cases the margins of this opening overlap each other, and thus entirely conceal the seed. This was first described by Fenzl*, who calls it "a brittle testa, covering the smooth cartilaginous endopleura." Endlicher†, on the other hand, designates it as an "arillus, covering a smooth corneous testa." Dr. Asa Gray‡, speaking of this tunic, "doubts if this membrane be a true arillus, as our materials are not sufficient for the complete investigation of its nature. Although marked with what seems like a raphe, it cannot be the testa or any proper integument of the seed, as Fenzl (in Pl. Hugel) took it to be, for it has no connexion with the corneous seed-coat at the chalaza, but only at the hilum; the chalazal end appears to be slightly open, as would be the case with an arillus: perhaps this membrane is a separable lining of the coccus."

I have not been able to detect the presence of any kind of vessels in this tunic, particularly in the prominent line that "seems like a raphe," and which Endlicher positively calls a raphe: this prominence appears to me nothing more than a mere impression of the sutural line of the coccus, and is a common feature seen upon the corneous coating of the seed in the *Colletieæ* and other Rhamnaceous genera. The tunic certainly presents all the characters of an arillus; and, as Dr. Asa Gray justly remarks, it cannot be one of the proper integuments of the seed. The hard seed of *Alphitonia* is perfectly sessile within it, and is attached to it by a small open transverse fissure in its base, as in *Zizyphus*.

Other circumstances, however, present themselves in the organization which I have found in the seed of *Alphitonia excelsa*, that are worthy of record, as they completely confirm all the details of structure previously described, and which seem to prevail thoughout the *Rhamnaceæ*. The second hard tunic, which lies within the outer brittle coating last described, becomes softened by maceration, when it is easily detached; it is then very lax, is of a pale-brown or yellowish colour, quite homogeneous in texture, void of any vessels, and encloses an oval body covered by a third tunic, which is notably smaller in size, and therefore leaves a considerable vacant space all round its sides and its summit, and is connected with the second tunic only at a small point in the base, which corresponds with the basal slit in the outer tunic of *Colletia* and *Zizyphus*. The summit of this third tunic is marked by a large tumid spot, evidently a chalaza, which exhibits no indication of any previous connexion with the

* Plant. Hugel, p. 20, sub *Colubrina excelsa*.
† Gen. Plant. no. 5712. ‡ Bot. Explor. Exped. Un. St. p. 278.

second tunic; along each margin, emanating from the basal point of attachment, and crossing over the chalaza, there is seen a prominent white cord, filled with spiral vessels, which is imbedded in the fleshy tissue of the integument, in one continuous and completely peripherical line, exactly like that described in *Colletia* and *Zizyphus*. Within this tunic is yet a fourth, delicate integument, a thin albumen, and an embryo similar in form to that of *Colletia**.

I have abstained from giving any denomination to the seed-coats in the foregoing descriptions; but we may now enter into this inquiry. In regard to the two inner coatings, no doubt can be raised against the obvious conclusion that the innermost is the tegmen produced from the secundine of the ovule, and that the other, in which the raphe is imbedded, is the true testa, developed from the primine, notwithstanding its soft fleshy texture. What, then, is the nature of the outer hard corneous coating in *Colletia*, the external crustaceous covering in *Rhamnus*, and the second tunic in *Alphitonia*? for there can be no doubt that they are all similar in their nature, and all derived from the same origin. The larger size of this tunic in *Alphitonia*, its lax condition in regard to the testa which it envelopes, the total absence of any cicatrix or mark that could indicate any previous connexion with the chalazal disk of the testa, are circumstances that manifest a distinct and subsequent origin. Indeed we have seen the proof of this in the seeds of *Rhamnus* (*ante*, p. 89), where in the same fruit we have found fertile and sterile carpels: in the latter case, the spiral vessels of the raphe were imbedded in the substance of the outer tunic of the ovule; in the former case, this raphe was found only in the second coating of the ripe seed: another adventitious coating, perfectly deficient of vessels, in the interval of growth had thus manifested its existence, apparently developed from the fleshy funicle which had simultaneously disappeared. This adventitious coating must therefore come within the category of an arillus. In such case the question presents itself—what is the nature of the outer brittle tunic in *Alphitonia*? Is it also an arillus, and have we in this genus two distinct arilli enveloping its seeds? The truth of this conclusion, at first sight, appears subject to little doubt.

On the other hand, I must not omit to record an instructive fact that I have observed in the fruit of *Alphitonia excelsa*. The fruit consists of three carpels, and, in the instance examined, only one of these contained a perfect seed; the two sterile carpels presented a single erect ovule, each being half the length of

* The details of structure of the ovule and seed of *Alphitonia* will be shown in plate 33 F of the 'Contributions to Botany.'

the carpel; the ovule was of an oval form, it had become thick and opake, its foramen was closed, and it was sessile within a short cup, with a lax undulating border, that was borne upon a solid stipitate support, of the same length and diameter as the body of the ovule. This was evidently an early stage of growth of one of the two arilliform coats of the seed, but whether of the inner or outer one, it is not easy to determine.

I have here suggested the probable assumption that the hard corneous seminal coating in *Colletia*, and the crustaceous covering in *Rhamnus*, derive their origin from a growth of the funicle —an assumption strengthened by the original observations of Brongniart; but it might possibly be argued that this coating is developed from the primine of the ovule, simultaneously with the intermediate tunic in which we find the double raphe-like cord, in the same manner as has been contended, in the case of *Magnolia* (which I have endeavoured to show has been contested upon erroneous grounds), that these two tunics form a compound testa, both developed from one single ovular coating, the primine. Against this supposition, in the case of *Rhamnaceæ*, many serious objections present themselves, in addition to those I have elsewhere advanced*:—1. No trace of vessels of any kind is found in the outer coating. 2. There is no scar or other mark upon the apex of this outer coating, to indicate its previous attachment to the chalaza of the intermediate raphigerous tunic; on the contrary, there is always a considerable vacant space between that summit and the chalaza. 3. In many species of *Rhamnus*, this external crustaceous covering does not form an entire coating, but is open from top to bottom, as an enfolded flat plate would be: this could not possibly happen if it were a resilient portion of the growth of the primine. 4. In the ovule, we find a long funicle supporting it, which disappears altogether in the seed. 4. This disappearance of the funicle takes place very soon after the period of impregnation of the ovule, when it becomes lost within a thickening around the micropylar extremity of the primine, which is then enclosed by it, apparently as if this thickening, and the formation of the outer crust, proceeded from an expansion of the funicle. We may hence draw the almost certain conclusion that this external seminal tunic is of adventitious origin, and of a distinct growth, subsequent to the period of the fertilization of the ovule.

In regard to the yet more external brittle covering of the seed of *Alphitonia*, there appears no sufficient evidence to indicate the precise source of its origin with any degree of certainty; but the facts I have already recorded concerning the sterile car-

* Linn. Trans. xxii. 86; Ann. Nat. Hist. 3 ser. i. p. 280; ibid. ii. p. 185; ibid. iii. p. 132, note, and pp. 144, 145, note.

pels are of some value towards this end. It may be argued, as indeed it has already been suggested by Dr. Asa Gray (*ante*, p. 91), that this covering may belong to the pericarp, and not to the seed. This suggestion, however, may be regarded under two distinct points of view: the covering may be considered either as consisting of a resilient portion of the endocarp, or as a separate development formed within it, analogous to the ordinary arilliform productions around seeds. The former view conforms with the suggestion of Dr. Asa Gray, and coincides with the line of argument adopted by him in regard to the seed-coats of *Magnolia*, to which I have just alluded; and upon this supposition, the brittle covering of the seed of *Alphitonia* would consist of the endodermal lining of the endocarp, which becomes separated from it under the form of a resilient membrane. We have, however, strong evidence to prove that no such occurrence has taken place; for if it had, this tunic ought to exhibit on its ventral face the same sutural line of dehiscence that the endocarp does; on the contrary, we find the ventral face of that tunic perfectly entire, though marked by the impression of the hollow sutural line of the endocarp; and we notice an aperture in its apex, often continued some way down the dorsal face, and that this opening does not form a sutural line, but that its margins are sinuous and overlap each other. It is therefore quite manifest that, if this tunic belong to the pericarp, it cannot be any resilient portion of the endocarp.

Under the second mode of viewing this question, that it is a distinct formation, much evidence, in the way of analogy, may be drawn from other well-known cases; but I will refrain from entering into this consideration at present, as I shall on a future occasion discuss the nature of other adventitious coatings within the pericarp of seed-vessels, which seem to originate in peculiar depositions, or from the growth and expansion of the placental surface. Among the many kinds of development of this class, which seem to have attracted little notice, may be mentioned the pulpy sacs in which the seeds of *Cucurbitaceæ* are severally enveloped, each sac being attached to a distinct bundle of tracheal vessels branching from the broad placental laminæ, as described by St.-Hilaire*, where these pulpy sacs are at first solid and fleshy, and afterwards become liquid and mucilaginous. A very similar growth is developed from the placentary plates of the fruit of *Adansonia*, where a thick deposit is formed around each seed. *Leguminosæ*, too, offer numerous examples of analogous growth. The large ball of elastic silky hairs that envelope the seeds in *Bombax* and other kindred genera derives its growth wholly from the pericarp, and not from the seeds. In *Hydro-*

* Mem. Mus. v. 306.

phyllum and *Ellisia* (Gærtn. pl. 110 & 184), the placenta grows round the seeds, which it soon encloses entirely, and fills the cell of the fruit. When the capsule bursts, this looks like an internal coccus, assuming the appearance of a resilient endocarp, which opens into two valves corresponding with those of the capsule; and upon the inner surface of these placentary valves the seeds are parietally affixed.

[To be continued.]

IX.—*On* Clostophis *and* Rhiostoma, *new Burmese Genera of Land-Shells*. By W. H. Benson, Esq.

*Clostophis**, B., nov. gen.

Testa sub-biconica; anfractus penultimus maximus, ultimus descendens, solutus, subaxialis, minor; apertura integra (specie adhuc cognita), dentata.

C. Sankeyi, B., n. s.

Testa late umbilicata, sub-biconica, lævi, spira turrito-conica, lateribus cavis, apice obtuso, sutura profunda; anfractibus 5, primis angustis convexiusculis, penultimo multo majore cylindrico, ultimo antice rapide descendente, soluto, tubuliformi, quoad peripheriam antepenultimi minore; apertura integra, subaxiali, subumbilicali, valde obliqua, subcirculari, intus superne dente 1 submarginali loco quasi parietali munita, peristomate tenui, expanso.

Diam. major $1\frac{1}{2}$, alt. $1\frac{3}{4}$ mill.

Habitat prope Moulmein, ad cavernas "Farm Caves" dictas.

I discovered this singular shell in the earth which filled the cavity of a decayed specimen of *Sophina schistostelis* collected by Major R. H. Sankey. It was accompanied by a minute and new species of *Hydrocena*. The specimen is weathered. Notwithstanding the presence of a tooth in the aperture, there is little room for hesitation in referring this novel form to the *Cyclostomacea*, with reference to the solute descending last whorl, and to the entire subcircular aperture, the expanded margin of which forbids an union with *Aulopoma*, from the impossibility of its being furnished with a similar operculum; while the absence of a slit and crowning tubular process prevents association with *Rhiostoma*. That the presence of a tooth within the aperture does not militate against Cyclostomaceous affinity is demonstrated by its occurrence in the genus *Diplommatina*†.

* *κλωστὸς*, coiled; *ὄφις*, serpent.

† In the Brazilian *Cyclostoma disjunctum*, Moricand, the solute last whorl descends laterally, as in *Aulopoma*.

A slight pit is discoverable on the outside of the last whorl near the aperture, corresponding with the internal tooth; but, from its situation and the minuteness of the object, it is difficult precisely to ascertain its nature.

If *Clostophis* should eventually prove to be destitute of an operculum, and allied to the *Helicidæ*, it will then form a curious contrast with its northern Burmese neighbour *Hypselostoma*, in which a tubular termination to the last whorl is exalted vertically above the apex of the shell.

Rhiostoma *, B., nov. gen.

Testa subdiscoidea, late umbilicata; anfractus ultimus solutus, lateraliter descendens; apertura libera, superne incisa, tubulo imperfecto retroflexo rimam coronante. Operculum breviter cylindricum, multispiratum, apice plano, lævigato, intus profunde excavatum.

Rhiostoma Haughtoni, B., n. s.

Testa late umbilicata, convexo-depressa, solidiuscula, oblique scabre striatula, superne castanea, subtus albida, fascia angusta mediana saturatiore, utrinque angulato-marmorata, ornata; spira depresso-conoidea, apice prominulo obtusiusculo, sutura impressa; anfractibus 5, convexiusculis, ultimo cylindrico, antice longe soluto, lateraliter descendente, superne carina obtusa a sutura usque ad tubulum marginalem decurrente munito; apertura libera, obliqua, diagonali, circulari; peristomate subduplici, extus incrassato, reflexiusculo, superne ad sinistram inciso, tubulo imperfecto, antice aperto, sinistrorse erecto, rimam coronante, munito; umbilico perspectivo, profundo: operculo testaceo, multispirato, breviter cylindrico, apice planato, lævigato, anfractibus arcte convolutis, marginibus acute carinatis, spatiis intersitis epidermide scabra vestitis; intus profunde excavato, polito.

Diam. major 21, minor 11, axis $8\frac{1}{2}$ mill.

Habitat ad cavernam Damathá, non procul ab urbe Moulmein.

This shell was discovered by Capt. J. C. Haughton, to whom I am indebted for a couple of specimens, one of which was alive. A weathered specimen, from the same source, was previously received from Mr. W. Theobald, junr., who has since forwarded the animal in spirits. I have mislaid my note on the living animal, which came out freely, but was in a languid condition. From the remains of the mollusk in the other shell, I procured two elongated-triangular, testaceous plates, somewhat convex on one side and concave on the other, and irregularly toothed or jagged on the longest and shortest sides.

Mr. Theobald was disposed to place his first specimen in the

* Ῥίον, a promontory.

genus *Aulopoma*; but the acquisition of an operculum induced him to class it with *Pterocyclos*, as Pfeiffer has in fact done with two allied species from Siam and Cochin China, although he has referred the former, *Cycl. Housei*, Haines, to the second section of *Pterocyclos*, "anfractu ultimo spiraculo munito," in company with *Pt. hispidus*, Pearson, in which the construction and site of the spiracle are very different; while he has placed the Cochin Chinese species, *Pt. tener*, Menke, in his third section. It is evident that the solute aperture, coupled with the incision at the top of the aperture and the subtubular prominence crowning the slit in both these species, separate them from all known *Pterocycli*, and associate them with the Burmese species now described.

Another feature common to the Tenasserim and Siamese *Rhiostomata* exists in the keel extending from the tubular process to the suture at the junction of the penultimate whorl, and not noticed in *R. tener*.

Sp. 2. *Rhiostoma Housei*, Haines.

Syn. *Pterocyclos*, Pfr. No. 3. sect. 2. Mon. Pneum. Suppl.
Cyclostoma, Haines, Ann. Lyceum, New York.

Hab. Siam.

Sp. 3. *Rhiostoma tener*, Menke.

Syn. *Pterocyclos*, Menke, Mal. Blätter, 1856.
Pterocyclos, Pfeiffer, No. 15. sect. 3. Mon. Pneum. Suppl.

Hab. Turon, Cochin China.

The long-lost *Turbo foliaceus*, Ch., which, on the authority of Dillwyn, has been unaccountably confounded with the very distinct Socotrine species, *Otopoma naticoides*, Recluz, proves to be an inhabitant of the Andaman Islands. A small variety, forwarded by Mr. Theobald, may be at once recognized as that species by its form, colour, and distant variciform plicæ on the last whorl behind the aperture. Were it not for a thin Cyclophoroid horny operculum, stated to belong to this shell, I should have been disposed to place it in *Otopoma*. The plicæ vary in number, and are even altogether wanting.

A small *Helix*, a *Streptaxis*, and a *Helicina* accompanied *C. foliaceus*, and were collected in the same locality, unexplored since the date of Dr. Helfer's fatal attempt.

Cheltenham, January 5, 1860.

X.—*On the Nomenclature of the* Foraminifera.

By W. K. Parker, M. Micr. Soc., and T. R. Jones, F.G.S.

Part III.—*The Species enumerated by Von Fichtel and Von Moll.*

The work we have now to treat of has been already incidentally noticed in our former papers. It is entitled :—

"Testacea Microscopica aliaque minuta ex generibus Argonauta et Nautilus ad naturam delineata et descripta a Leopoldo a Fichtel et Jo. Paulo Carolo a Moll. Cum 24 Tabulis æri incisis."

("Microscopische und andere kleine Schalthiere aus den Geschlechtern Argonaute und Schiffer, nach der Natur gezeichnet und beschrieben von Leopold von Fichtel (Mitglied der Linneischer Gesellschaft zu London, und der Asiatischen zu Calcutta), und Joh. Paul Carl von Moll. Mit 24 Kupfertafeln. 4to. Wien, 1803.")

In the works of Walker and Montagu previously noticed by us*, we have had to do with, for the most part, dwarfish forms belonging to northern habitats; and hence many of them have had to be ranked as varieties, of but secondary value zoologically. In the Linnæan list of *Foraminifera* (see our paper in the Ann. Nat. Hist. 3 ser. vol. iii. p. 474, &c.) there are several typical forms, which attracted the attention of the older naturalists; but in the work before us we have a fine, though incomplete, series of large, well-grown, specific types, which have been the source of numerous quasi-generic and pseudo-specific distinctions in the works of later authors. These writers have been guided by the false analogy of Molluscan types, which, however, have nothing in common with Rhizopodous shells, except similarity of form, or isomorphism; and it was not until naturalists recognized the really low grade of the *Foraminifera*, as demonstrated by Dujardin (1835) with respect to several of their forms, that their classification was seen to be dependent upon a wide range of variation within specific limits, such as one again finds only in the lower members of the vegetable kingdom.

Fichtel and Moll, in their Preface, give a rapid glance at what had been already effected in the working out of the *Foraminifera*, and express their dissatisfaction with the result. The microscopical Nautiloid shells chosen by them for description are not, as a whole, illustrative of any particular fauna; but most of them are Mediterranean forms, either recent, or fossil from deposits belonging to the Mediterranean area, namely Tuscany and, in a few instances, the Austro-Hungarian district. The remainder were derived from the Red Sea.

As the specimens selected for illustration represent only one section or "genus," in the nomenclature used by these authors,

* Ann. Nat. Hist. ser. 3. vol. iv. p. 333, &c.

namely that which they termed "Nautilus," and as they intended to have figured and described (had the work paid its expenses) others of the sections proposed by them to constitute their genera "Hammonium," "Lituus," and "Orthoceras," a more complete illustration of the Mediterranean fauna, with specimens from other localities, would probably have been made, had their work been completed.

Impressed with the difficulty of defining species, these authors appear to have seized upon certain well-marked and, as a rule, large forms for description; and in some degree they were evidently led towards a conception of the true characters of a Rhizopodous species, as far as the Cristellarian forms are concerned; still they were so far trammelled with the notion of the Cephalopodous nature of these little shells, that they left the subject almost as they found it, except having put forward the important recognition of the often doubtful value of mere surface-marking and of outline in the characterization of the species. Their careful descriptions, however, and their well-drawn and neatly coloured figures mark an epoch in the bibliographical history of *Foraminifera*. Montagu, in our own country, at the same period was also bestowing care and taste on the description and figuring of these little shells; but his work had not reached Vienna.

In the following Table we have arranged, according to their relations, the Rhizopodous shells figured and described by Fichtel and Moll; and we may remark here, as we have elsewhere, that it is not to confuse the student that we so freely group together under a few specific names the varieties that have received so many distinctive appellations, but to assist in the elucidation of the exact relationship of the several forms; so that, instead of separate and unintelligible atoms, to be classed only according to their shape and size, the *Foraminifera* may be ultimately seen to fall into natural groups intimately related and at once carrying their meaning, physiologically and zoologically, to the educated eye. We have many collaborators in this pleasing task, at home and abroad,—some strong in long experience of these protean animalcules, some powerful with the microscope to unravel their tissue, some bringing a rich knowledge of other forms of life to the work. We gladly contribute the result of our own gatherings in these several branches of research, and firmly believe that ultimately, with conscientious labour, and free expression of independent opinions, the Rhizopodists will arrive at the hoped-for result of placing these *Microzoa* on as good a basis of classification as that on which many of the higher groups of animals now rest. We may repeat, too, that the varietal names already established are not by any means thrown aside by us in

The Foraminifera *enumerated by* Fichtel *and* Moll, *arranged systematically.*

1. POLYSTOMELLA (Nonionina) asterizans.	A Nonionine subspecies of POLYSTOMELLA : type, P. CRISPA. [The varieties appear in Italics.]
2. —— —— *incrassata.*	
3. —— —— *pompilioides.*	
4. —— —— *Scapha*	
5. —— —— *Faba*	
6. —— *striatopunctata.*	
7. —— *ambigua.*	
8. —— *macella.*	
9. —— *strigilata.*	
10. —— CRISPA (Linn.)	The typical species of the genus POLYSTOMELLA.
11. —— *craticulata.*	
12. NUMMULINA *radiata*	Small varieties of N. PLANULATA.
13. —— *venosa*	
14. —— *Mamilla*	Probably varieties of N. PLANULATA. "N. lenticularis, γ," may possibly be a variety of N. LÆVIGATA.
15. —— *lenticularis, α, β, γ, δ, ϵ*	
16. Cristellaria Calcar (Linn.)	C. Calcar stands in the relation of a subspecies to NODOSARINA RAPHANUS. For the sake of binomial convenience, Cristellaria is retained as a subgeneric term, of equal value to Nodosaria.
17. —— *papillosa.*	
18. —— *Vortex.*	
19. —— *costata.*	
20. —— *acutauricularis.*	
21. —— *Crepidula.*	
22. —— *Cassis.*	
23. —— *Galea.*	
24. CALCARINA SPENGLERI (Gmel.)	This is a good species of a subgenus of ROTALIA.
25. ROTALIA REPANDA	A typically specific form of a genus.
26. —— *sinuata.*	
27. —— *Auricula.*	
28. PLANORBULINA FARCTA	A typical species of a subgenus of ROTALIA.
29. —— *tuberosa.*	
30. PENEROPLIS PLANATUS	A good species, belonging to a well-marked genus.
31. ORBICULINA ADUNCA	A specific type of an accepted genus.
32. —— *Orbiculus.*	
33. —— *angulatus.*	
34. ALVEOLINA MELO	Generic and specific.

general use, unless they are in duplicate, or otherwise quite unnecessary; but that these, and as many more as it may be requisite to propose, must be used in descriptions and comparisons—their really slight zoological value being always kept in mind.

1. Nautilus asterizans. Page 37, pl. 3. figs. *e–h*. "Recent: Zoophytic concretions *, Mediterranean." This is a *Nonionina*, small, many-chambered, and Nautiloid; it has a slight umbilicus, around which an exogenous growth of shell-matter radiates along the concave septal lines to about one-half their length. It inhabits sandy shores and estuaries, and is common, in its many varieties, both in the fossil and the recent state. This is one of the typical forms of *Nonioninæ* (which, after all, are but low forms of *Polystomella*). It exhibits the chief features which are seen in different degrees of development in other related forms. Its astral limbation is a feature which is much exaggerated in *N. limba*, D'Orb. (Modèles, No. 11), and curiously modified with flaps in *N. stellifera*, D'Orb. (Foram. Canaries, pl. 3. figs. 1, 2). The figure in Soldani's 'Testaceograph.' referred to by Fichtel and Moll with some doubt, as equivalent to *N. asterizans*, is clearly not related.

2. Nautilus incrassatus. Page 38, pl. 4. figs. *a–c*. "Recent: Portoferrajo, Isle of Elba, Mediterranean." An umbonate variety of *Nonionina asterizans*; it has deeply sulcate septal lines, and is more rounded at its periphery than the foregoing, from which also it generally differs in having a closer texture with finer pores. Many of the forms of *Nonioninæ* which have received specific appellations exhibit considerable variableness in the size of the perforations of their shells. *N. incrassata*, F. & M., and *N. Scapha*, F. & M., have usually the finest, *N. granosa*, D'Orb. and *N. perforata*, D'Orb., the coarsest pores.

N. incrassata lives, with other varieties of *N. asterizans*, in the shallow waters of the Mediterranean; it occurs fossil at Grignon, and is the same as *N. lævis*, D'Orb. (Modèles, No. 42), fossil from Bordeaux. The umbo, in some of the astral forms, is represented by granules, as in *N. tuberculata*, D'Orb. (For. Foss. Vien. pl. 5. figs. 13, 14).

A small delicate variety of *N. asterizans* (from Cuxhaven), intermediate between *N. depressula* and *N. crassula* of Walker, is accurately figured, with the colours of nature, by Prof. Ehrenberg, in the 'Abhandl. Akad. Berlin, 1839' (1841), pl. 2, figs. 1 *a*–1 *g*. It is here termed "*N. Germanica*."

* In the shelly deposits of the Mediterranean, and at the base of coral-reefs, we find such concreted masses of broken shells, Bryozoa, Nullipores, &c., as are here doubtlessly referred to.

3. Nautilus pompilioides. Page 31, pl. 2. figs. *a–c*. "Recent: zoophytic concretions, Mediterranean. Fossil: Coroncina, Tuscany." A small, common, Nautiloid *Nonionina*. Subglobose, with flush cells, which are not so numerous as in *N. asterizans*, umbilicate, smooth, intermediate as to the size of its perforations between *N. incrassata* and *N. granosa*. This is one of the subglobose varieties of a subspecies, the peculiar features of which are best represented by *Nonionina asterizans*. The *N. umbilicata* of D'Orbigny's 'Modèles' (No. 86) and *N. Soldanii*, D'Orb. (Foram. Foss. Vienne, pl. 5. figs. 15, 16), are closely related varieties. The *N. crassula*, Walker, *N. depressula*, Walker, and *N. umbilicata* of Montagu (not Walker), are also nearly allied, but they are thinner, and have the septal joints more deeply sunken. *N. tuberculata*, *N. perforata*, *N. granosa*, *N. punctata*, *N. communis*, and *N. Boueana* (D'Orb. For. Foss. Vien. pl. 5) are forms akin to *N. Soldanii*, and present varietal conditions of outline, of ornament, and of foramina within the limits of specific latitude.

N. pompilioides is very common fossil in the Subapennine clays, and recent in deep water (especially at from 100 to 500 fathoms) in the Mediterranean and other seas.

N. pompilioides bears the same relation to *N. asterizans* that *Rotalia Soldanii* does to *R. Beccarii*, being a thick form with flush cells, which in shallow water become more outspread with gibbous chambers.

The following references to Soldani's figures by Fichtel and Moll, for this species, are correct: Soldani, Sagg. Oritt. p. 100, pl. 2. fig. 16 *t t*, T T, V V, X X.; Testaceogr. vol. i. p. 59, pl. 46. fig. *q q*.

4. Nautilus Scapha. Page 105, pl. 19. figs. *d–f*. "Recent: Adriatic Sea." This is an oblong variety of *Nonionina asterizans*, rapidly increasing in the size of its chambers. It is the *Nonionina communis*, D'Orb. (For. Foss. Vien. pl. 5. figs. 7, 8). This variety is of common occurrence in all seas, and also in the Tertiary deposits.

5. Nautilus Faba*. Page 103, pl. 19. figs. *a–c*. "Recent: sand from Rimini and other parts of the Adriatic and Mediterranean. Fossil: Sienna, Volterra, and near S. Quirico." This is an interesting variety, showing the first trace of passage between *Nonionina* and *Polystomella*,—further links of union being supplied by the next-mentioned variety (*P. striatopunctata*), of which this may be said to be an oblong form. The aperture is here crossed with little bars; and the septal lines also are bridged over in some specimens; both of which features

* This form is not related to the figures referred to in the works of Soldani and Plancus.

are carried to greater extent in the following varieties. This variety is not common; our best specimens are from the Arctic Seas.

6. Nautilus striatopunctatus. Page 61, pl. 9. figs. *a–c*. "Recent: Red Sea*." A smooth round-edged Nonionine shell, variable in its thickness and in the number of bridges over the septal spaces. Its aperture varies from the simple cross-slit to the cribriform plate. Here the Nonionine character is merged in that of *Polystomella*, the septal lines being more or less regularly bridged over, though often so minutely as to escape casual observation. When more developed, these bridgings of the septal lines produce not only linear pits, but sometimes a double row of septal galleries. In the *P. gibba* of Schultze the septal bridges are well developed, and a further growth of exogenous matter takes place over the whole shell, in the form of elegant sinuous patches of transparent calcareous granulations. A still greater modification of the surface obtains in *Polystomella crispa* and its allies, presently to be noticed.

P. striatopunctata sometimes has the simple crescentic aperture of *Nonionina*; but this is often subdivided by calcareous bars, and so becomes the cribriform septal plane of *Polystomella*. It may be either umbilicate or umbonate; and the umbo may be granulated, and so afford a gradation into *Nonionina granosa*, D'Orb.

Polystomella, indeed, is but a more complex form of *Nonionina*. They belong to one generic group; and indeed we seem to have but one, or at most two, species here. Some of the *Nonioninæ* (of the *N. sphæroides* type) are probably of a different specific group. As two subspecies, the *Nonionina asterizans* and *Polystomella crispa* may be retained in nomenclature with advantage—*N. asterizans* being the central form of one, and *P. crispa* that of the other; but *Polystomella* is the true leading form.

Nonionina striatopunctata occurs in shore-sand nearly everywhere, especially in the Arctic Seas, where it attains its greatest size, and is accompanied by *N. Faba, N. Scapha,* and *N. stellifera*. It is found fossil in the Upper Tertiaries.

Ehrenberg has well figured, with natural colours, some living specimens of *N. striatopunctata* (under the name of *Geoponus Stella-borealis*), from Cuxhaven, in the 'Abhandl. Akad. Berlin, 1839' (1841), pl. 1. figs. *a–g*.

7. Nautilus ambiguus. Page 62, pl. 9. figs. *d–f*. "Recent: Red Sea†." This is a somewhat flat *Polystomella*, slightly umbonate, with the septal spaces open, rendering the chambers

* In sand obtained from large shells, and given to the authors by Spengler.

† In sea-sand from shells, given by Spengler.

somewhat vesicular and the outline crenulate. It approaches near to the typical *P. crispa,* and is a common variety. D'Orbigny has figured a similar form under the name of *P. Listeri* (For. Foss. Vien. pl. 6. figs. 19–22).

8. Nautilus macellus (two varieties). Page 66, var. α. pl. 10. figs. *e–g*; var. β. pl. 10. figs. *h–k*. "Recent: Zoophytic concretions, Mediterranean." Var. α is a sub-complanate, slightly unsymmetrical *Polystomella*: the unequal development of the two faces is an interesting feature. Var. β is symmetrical, not quite so flat as var. α, and is lobated in its outline by a periodical irregularity of growth, peculiar perhaps to the individual. Both of these are thin varieties of *Polystomella crispa.*

D'Orbigny has recognized the similarity of his *P. Fichteliana* (For. Foss. Vien. p. 125, pl. 6. figs. 7, 8) to *P. macella,*—a similarity too close, in our opinion, to allow of any distinction.

P. macella, when plano-convex, would be equivalent to the *Faujasina carinata,* D'Orb. (For. Foss. Vien. p. 194, pl. 21. figs. 29–31) from the chalk of Maestricht.

This variety and other flat *Polystomellæ* are very common in the shallow waters of the Mediterranean and the tropical seas, and have been washed into the sands from the sea-weeds to which they have been attached by their flattest surface. This face often shows the whole coil of the spire, as in *Faujasina carinata,* D'Orb.

A large symmetrical umbonate variety, near to *P. macella,* var. α, occurs in great abundance in some of the Subapennine and other Tertiary sands and clays.

Polystomella macella is more unsymmetrical than any Operculine variety of Nummulite, but not so much so as is the rule in *Amphistigma vulgaris* (=*A. gibba*): in the latter the aperture is a large slit nearly all on the more bulging side; whilst in *Polystomella macella,* when most twisted in its growth, the septal plane and aperture are but little affected, indeed scarcely more so than in the unequally gibbous *Operculinæ.* Both the symmetrical and unsymmetrical Nautiloid Foraminifers delight in complanate varieties; and these are often the more irregular in their growth because of their weak and starved condition.

The peculiar twist acquired by the complanate *Polystomellæ* is equalled by that in the Australian *Vertebralinæ,* both discoidal and crozier-shaped, which, although showing just the same kinds of variation as they are wont to do in other parts of the world (and in fossil deposits), yet have, one and all, their mouth turned more or less to one side; and in the very flat discoidal varieties the shells are often saddle-shaped.

Polystomella, in its very small and simple varieties, as well as its very large and complex forms, and also in its often prickly

and occasionally strongly spinous varieties, has a peculiar and interesting parallelism with *Rotalia Beccarii*.

9. Nautilus strigilatus (two varieties). Page 49, var. α. pl. 5. figs. *c–e*; var. β. pl. 5. figs. *f*, *g*. "Recent: Poville, near Novi, Austrian shore of the Adriatic." Var. α is a somewhat flattened *P. crispa*, with a small umbo, which, however, is relatively larger than in the foregoing varieties. Var. β is a rowelled condition of the same, and is the *P. aculeata*, D'Orb. (For. Foss. Vien. pl. 6. figs. 27, 28). Both are common shallow-water forms. Fichtel and Moll refer correctly to Soldani, Testaceogr. vol. i. p. 54, pl. 34. fig. 1, for this form.

10. Nautilus crispus. Page 40, pl. 4. figs. *d–f*. "Recent: Adriatic. Fossil: Etruria." The references to Plancus and Soldani for figures of this species are correct: Plancus, Conch. p. 10, pl. 1. fig. 2; Soldani, Sagg. Orit. p. 100, pl. 2. fig. 17 Y Z; Testaceogr. vol. i. p. 54, pl. 33. fig. F, and pl. 34. figs. G, H. This is the typical *Polystomella crispa*, Linnæus, being an intermediate state of development between that of the thin, flat, depauperated *P. macella* and the very thick, largely umbonate, and frequently gigantic *P. craticulata*. It is of world-wide distribution, and occurs fossil in the Tertiaries. Its relationship to *Nonionina* is alluded to at pages 101 & 103.

11. Nautilus craticulatus. Page 51, pl. 5. figs. *h–k*. "Recent: Red Sea. From sea-sand in large shells: given by Spengler."

This is the form of *Polystomella* which attains a very large size among the coral-reefs of Fiji, Red Sea, Australia, and New Zealand, also at the Canaries and the Philippines. In the figure referred to the umbo is drawn large, but frequently we have met with massive individuals, from the Australian reefs, having this central exogenous growth extending over nearly the whole of the shell, small patches only of the septal structure appearing here and there towards the margin. Indeed, this masking of the surface has been erroneously regarded by some as characteristic of a specific difference. Not only in this large Polystomellous species, but in many specific groups of Foraminifers, superficial shelly matter may either be wanting or be developed to any extent, without proving essential distinctness.

It occurs fossil in the Miocene Tertiary beds of San Domingo.

12. Nautilus radiatus. Page 58, pl. 8. figs. *a–d*. "Recent: Red Sea." In sea-sand from the interior of shells in Spengler's collection.

This is a small, smooth, lenticular *Nummulina*, about 1 line in diameter; marked with twenty-four radiating, translucent, septal lines, slightly sinuous, with an open sigmoid flexure, which extends from the periphery to the umbonal centre, and as many intermediate short parallel septal lines towards the peri-

pherical margin. These indicate altogether nearly fifty chambers in the outer whorl, the lateral lobes of which, in passing towards the umbonal centre, interfere with each other, leaving only indications of half as many elongate triangular sinuous umbilical lobes.

In the section, fig. *c*, we see four whorls and a round central primordial cell; and the outer whorl has seventeen chambers, narrow from back to front, transversely wide, and obliquely set.

13. Nautilus venosus. Page 59, pl. 8. figs. *e–h*. "Recent: Red Sea." From shell-sand sent by Spengler.

A small, smooth, lenticular *Nummulina* (1 line in diameter), marked with twelve translucent, sinuous, radiating septal lines, several of which appear to bifurcate, and some to trifurcate, at their peripheral extremities. These may indicate seventeen chambers of irregular width, the umbilical lobes of which interfere with each other, leaving only about twelve broad triangular lobes on the surface, with small intercalations. In the section, fig. *g*, three and a half whorls and a central cell are seen; the outer whorl is here figured as made up of twelve rhombical chambers.

The only difference between *Nummulina venosa* and *N. radiata* is that in the latter the chambers are relatively larger (twice the size), the segments of sarcode produced at each gemmation having been thicker from back to front than in the former shell. The angle at which the segments are set on is the same in the two shells, and the lobes or flaps laid on the umbilical surfaces have in both the same gentle sinuous form, though in one shell they are of half the size that they are in the other. As the relative size of the segments cannot be accepted as a specific distinction, we do not regard these two *Nummulinæ* as belonging to separate species. Fichtel and Moll themselves had some hesitation in giving them two names.

In Prof. Williamson's *Nummulina planulata*, Monogr. p. 37, pl. 3. figs. 76, 77, we have a similar little shell ($\frac{1}{12}-\frac{1}{16}$ inch in diameter), with straight or rather wavy radii: the umbilical area is left open by the shortened apices of the lateral lobes, so that parts of the former whorls are visible,—a condition retrospective of some *Operculinæ*. Prof. Williamson had his specimens from Portsmouth and Scarborough; and he refers it correctly to the *N. planulata* of Lamarck, more especially to the biconvex variety known as *N. variolaria*, Lam. We have no doubt of this belonging to the same species as the two varieties above mentioned, although the curvature of the septal lines is modified in some of the later chambers, and though there is an umbilical deficiency of shell-matter. From Hund Island, in Davis Strait, we have some small, delicate, recent *Nummulinæ*

(dredged by Dr. P. C. Sutherland, at 25 to 30 fathoms) of the same type as the above, presenting sinuous radial lines of the same pattern as those in *N. radiata*. Recent *Nummulinæ* of larger size than any of the foregoing (about $\frac{1}{5}$ inch in diameter) are abundant along the Australian coral-reefs at from 10 to 20 fathoms, as shown by dredgings brought from Australia by Mr. Jukes. These show radiating septal lines of a similar sigmoidal pattern, and thus closely resemble D'Orbigny's *Nummulina radiata* * (For. Foss. Vien. p. 115, pl. 5. figs. 23, 24). This Viennese Nummulite D'Orbigny has referred to Fichtel and Moll's *Num. lenticularis*, var. δ, but, we believe, erroneously, as far as varietal relationship is concerned. The Australian *Nummulinæ* just mentioned freely pass into *Operculinæ*, of a rather larger growth, by the gradual loss of the triangular overlying flaps of sarcode,—gradations being thus made between such a form as that above quoted from Williamson's 'Monograph,' through innumerable and gentle stages, into flat outspread *Operculinæ* and *Assilinæ*, exposing their bare whorls. In these Australian dredgings the individuals are excessively numerous, in an almost purely calcareous mud, constituting in some instances upwards of fifty per cent. of the deposit. These Foraminifers are accompanied by a great variety of *Orbitolites*, *Alveolinæ*, *Polystomellæ*, *Miliolæ*, *Rotaliæ*, &c., mostly of large size. This fauna is strikingly a counterpart of the Calcaire grossier.

14. Nautilus Mamilla. Page 53, pl. 6. figs. *a–d*. "Fossil: Brunn near Steinfeld, Neusiedler See, Margareth, Maria Loretto, Kroisbach, and other places in Lower Austria and on the confines of Hungary."

A smooth lenticular Nummulite ($1\frac{1}{2}$ line in diameter), with thin edges and a raised umbonal centre on each face. In fig. *c* $5\frac{1}{2}$ whorls are shown, with 24 oblique chambers in the outer whorl; the central cell is small.

Vicomte d'Archiac and M. J. Haime, in their 'Monographie des Nummulites' (contained in their 'Description des Animaux Fossiles du Groupe Nummulitique de l'Inde,' 4to, Paris, 1853), express an opinion that "Nautilus Mamilla" is probably *Nummulina Ramondi*, Defr., var. *d* (Monogr. p. 129, pl. 7. figs. 13–17): this may be, though the evidence is not very clear.

15. Nautilus lenticularis. Five varieties; p. 55. "Fossil: Klausenberg in Transylvania.

Var. *a*, pl. 6. figs. *e–h*. A small, smooth, thickly lenticular

* MM. d'Archiac and Haime pass over this Nummulite, suggesting that it may be an *Amphistegina* (Monogr. p. 160). It is, however, a true Nummulite in all its characters. We do not know of any bilaterally symmetrical *Amphistegina*.

Nummulite, 2 lines in diameter. The section, fig. *g*, shows three whorls and a large central chamber; eighteen chambers in the outer whorl. The chambers, as to their relative size and setting-on, are like those of *N. Mamilla.*

By MM. d'Archiac and Haime *N. lenticularis*, var. *a*, is recognized as a species, and renamed *N. Tchihatcheffi*, Monogr. p. 98, pl. 1. fig. 9.

Var. *β*, pl. 7. figs. *a, b.* A small lenticular Nummulite, 2 lines in diameter, covered with closely-set granules; on the figure about thirteen granules lie in a row along the diameter of the shell.

According to MM. d'Archiac and Haime, this is *N. Lucasana*, Defr., var. *a*, Monogr. p. 125, pl. 7. fig. 7.

Var. *γ*, pl. 7. figs. *c–f.* A small, smooth, lenticular Nummulite ($3\frac{1}{2}$ lines in diameter), more convex on one face than on the other. In the section, fig. *e*, $6\frac{1}{2}$ whorls are seen, with the central cell large, and thirty-six chambers in the outer whorl (thirty-two on the fifth, and about the same number in the third whorl); chambers very like those of *N. Mamilla* and *N. lenticularis*, var. *a*, but more numerous.

MM. d'Archiac and Haime refer this to *N. Molli*, d'Arch., Monogr. p. 102, pl. 4. fig. 13.

Var. *δ*, pl. 7. fig. *g.* A small lenticular Nummulite, $3\frac{1}{2}$ lines in diameter, marked with twenty-four more or less curved or sinuous striæ, radiating from the periphery towards the centre of the face, but leaving a small clear umbonal area.

M. D'Orbigny collates this variety as identical with his *N. radiata*, For. Foss. Vien. p. 115; but we cannot coincide in this determination, though these varieties may belong to one species. According to MM. d'Archiac and Haime, this is *N. Biaritzensis*, d'Archiac, Monogr. p. 131, pl. 8. figs. 4–6.

Var. *ε*, pl. 7. fig. *h.* A small lenticular Nummulite, $3\frac{1}{2}$ lines in diameter, resembling var. *δ*, excepting that the interspaces between the radial lines are occupied with granules, mostly in single rows of from 4 to 7, but sometimes in double series towards the periphery.

This is *N. perforata* (Montf.), D'Orb., and accepted under that name by MM. d'Archiac and Haime, Monogr. p. 115, pl. 6. figs. 1–12.

These figures of five varieties of Nummulites, though boldly drawn and apparently with care, give us but little exact evidence of the real relationships of the originals. We have quoted the determinations arrived at by MM. d'Archiac and Haime, after considerable research; but, even with the aid of their pains-taking and minute descriptions and their numerous and faithful drawings, we cannot readily follow them to their conclusions.

Nummulinæ, like other *Foraminifera*, take such licence in their mode of growth, in the relative size and setting-on of the segments and their alar lobes, and in the exaggeration of the exposed septal lines and pillars by the, as it were, capricious growth of shell-matter, that it is difficult, even with the best-grown of these giants of the family, to determine where anything like specific limits can be marked out.

It appears to us that, in its style of growth, *Nummulina* is related to *Operculina*,—so closely, indeed, that, like *Assilina*, the latter sinks to the low grade of a subvarietal condition, there being no strict boundary between it and *Nummulina*, as we find abundantly proved by both recent and fossil specimens. Just so *Nonionina* loses itself in *Polystomella*.

The hundreds of indifferently described Nummulitic forms to be found in geological works were in 1853 reduced to order by the combined labours of M. le Vicomte d'Archiac and M. Jules Haime, and arranged as fifty-two species, grouped in six sections, —namely, 1. Nummulinæ læves aut sublæves; 2. Reticulatæ; 3. Subreticulatæ; 4. Punctulatæ; 5. Plicatæ vel striatæ; 6. Explanatæ (septa et spira plus minusve prominentes),—Nos. 1–5 forming the division characterized by "cloisons embrassantes, plus ou moins inclinées et arquées," No. 6 being a division by itself, with "cloisons non embrassantes et presque droites."

The group No. 1, "læves," have the alar or umbilical lobes attenuate (corresponding to the smallness of the segments) and extremely sinuous,—"filets cloisonaires simples, très-sinueux." This is the chief characteristic of the large, flat, smooth Nummulites forming the group, of which *N. complanata*, Lamarck, is the type. We should have preferred the term "sinuatæ" or "complanatæ" for the group. Groups No. 2 and No. 3, "reticulatæ" and "subreticulatæ," are characterized by the inosculation of the "filets cloisonaires" or alar lobes of sarcode proceeding laterally from the segments; they are so closely related, that we may regard them as one group, characterized by the net-like arrangement of the inosculating lobes, "réseau cloisonaire," and typified by *N. lævigata*, Lam. The "punctulatæ" of group No. 4 are, we believe, artificially brought together: they belong part to group 1 and part to group 5, and in some cases have very close relations with groups 2 and 3. The feature referred to as characteristic in group No. 4 is the granulation of the surface; and, owing apparently to the strange mistake of the authors (formerly made also by Dr. Carpenter in his Memoir on Nummulites in the Quart. Journ. Geol. Soc. vol. vi.*) in regarding the subcrystalline columns seen in sections of Nummulites (that is, the septal walls and pillars) as calcareous

* Corrected by him in Phil. Trans. vol. cxlvi. p. 558, *note*.

infillings of funnel-shaped holes or pores, the nature of these granulations was misunderstood by MM. d'Archiac and Haime. In a Nummulite of any of the groups the septal lines exposed on the surfaces may be thickened, built up, or exaggerated by ridges or granules of hyaline shell-substance permeated with tortuous passages—part of the so-called "vascular system" of the shell; and these exogenous granules need not be confined to the septal lines, but may be planted in the interspaces, as in *Amphisteginæ* and other cognate forms, and will thus stand as lines and pillars of division to the alar lobes as the new segments are successively added. This is markedly the case in *N. scabra*, Lam., the granulated variety of *N. lævigata*, and indeed in numerous instances among *Nummulinæ* and their allies. In many Nummulites the granulate surface may be found at one period of growth, and the smooth at another; for, if a new segment or segments have been lately added, the surface will be far smoother than in the stage when the external increase of the septal lines and pillars only is going on.

The group No. 5, "plicatæ vel striatæ," contains a great many varieties characterized by a simple radiate arrangement of the alar lobes, which are usually elongate triangular, straight or slightly curved, either falciform or sigmoid. These Nummulites are usually small, and are well typified by *Num. planulata*, Lamk. We should have preferred the term "radiatæ" for this group.

No. 6 is the Assiline group ("explanatæ"), in which the whole of the spire is apparent from the want of the alar lobes. *Assilina*, however, like *Operculina*, passes by insensible gradations into *Nummulina*, by the varying development of the lateral lobes or flaps.

There are individual specimens that tend to show a linking together of the "sinuate," "reticulate," and "radiate" groups; but for the present we propose to regard these as three *specific* groups, headed respectively by *Nummulina complanata*, *N. lævigata*, and *N. planulata*. The Assiline forms are probably related as varieties to the "radiate" and "sinuate" groups.

Having said thus much respecting the Nummulites generally, we return to Fichtel and Moll's illustrations, with the following remarks:—

N. Mamilla and *N. lenticularis*, var. α, do not present any indication of the superficial lobes; but, from the style of their chambers, they probably belong to the "radiate" group, and, for what we can see, are of the same species, the relative amount of convexity not being essentially distinctive.

N. lenticularis, var. β, may be the *N. Lucasana* (of the "radiate" group), as stated by MM. d'Archiac and Haime, but is

quite as like some of the granulate varieties of the "sinuate" group.

N. lenticularis, var. γ, is referred by MM. d'Archiac and Haime to the "reticulate" group, probably with justice, and to a new species. Nevertheless it much resembles their figures of *N. Tchihatcheffi* in every respect.

N. lenticularis, var. δ, is decidedly a "radiate" form, resembling *N. Ramondi, N. Guettardi, N. striata,* and others, even more than *N. Biaritzensis,* to which MM. d'Archiac and Haime refer it. The differences, however, are merely varietal.

N. lenticularis, var. ϵ, is far more like *N. Rouaulti* and *N. Lucasana* (of the "radiate" group) than *N. perforata* (of the "sinuate" group).

N. radiata, N. venosa, and their allies above described, are simple forms of the "radiate" group.

Nummulina, essentially symmetrical in all its varieties, is connected with the truly unsymmetrical species of Nautiloid Foraminifers by the unequal-sided *Amphistegina,* small varieties of which have a striking isomorphism with the Asterigerine varieties of *Rotalia Beccarii*—for instance, the *Asterigerina lobata* and *A. carinata* of D'Orbigny; but the Rotalian forms seldom hide their primordial cell in their successive folds, whilst this habit is constant in *Amphistegina,* however distorted it may become: thus this species never exposes its spire on both sides, like *Operculina,* nor on one side, as in *Polystomella macella* and the *Rotaliæ. Heterostegina* (a flattish Nummulitoid species with subdivided chambers) is in external form rather more like some *Operculinæ,* with the earlier portion lenticular, and with thin marginal chambers*, than an *Amphistegina;* and it bears the same relation to *Operculina* that *Orbiculina* does to *Peneroplis;* whilst *Cycloclypeus,* a species next beyond *Heterostegina* in development, is in this respect analogous to *Orbitolites.* See also Dr. Carpenter, Phil. Trans. 1856, vol. cxlvi. p. 565.

16. Nautilus Calcar. Page 69. Twelve varieties. Five varieties (*a*–ϵ): "Recent: Rimini shore, Adriatic. Fossil: Coroncina, near Sienna."

Var. *a*. Pl. 11. figs. *a–c*. Keeled, rowelled, ribbed, and um-

* The form here referred to, with its gently biconvex centre and thin edge, is the *Amphistegina Cumingii* of Dr. Carpenter, so fully described and illustrated in his last Monograph (read before the Royal Society, June 17, 1858, and published in the Phil. Trans. for 1859). We cannot agree with this talented author in placing this somewhat feebly developed Nummuline form in the genus *Amphistegina.* For our own part, we cannot, on any good physiological grounds, separate it from *Operculina complanata,* on the one hand, or *Nummulina planulata,* on the other, which latter we regard as the parental form of both.

bonate. A thick, well-developed *Cristellaria Calcar*: typical. See Annals N. H. 2 ser. vol. xix. p. 290; and ibid. 3 ser. vol. iii. p. 476.

Var. β. Pl. 11. figs. *d–f*. ("Plancus, Conch. p. 85, pl. 1. fig. 12, STV, and fig. 13 *z*, Z; Soldani, Sagg. Orit. pl. 1. fig. *g*, *G*, Testaceogr. vol. i. pl. 33. fig. B.") Keeled, ribbed, and umbonate. *Cristellaria cultrata* of authors: a common well-developed variety.

Var. γ. Pl. 11. figs. *g–h*. Keeled, rowelled, bead-ribbed, and umbonate.

Var. δ. Pl. 11. figs. *i–k*. Keeled, rowelled, and bead-ribbed. γ and δ are varieties of *C. Calcar* ornamented with granulated septal lines.

Var. ε. Pl. 12. figs. *a–c*. ("Soldani, Sagg. oritt. p. 98, pl. 1. fig. 6 J; Testaceogr. vol. i. pl. 59. figs. *q q*, *r r*.") Keeled, rowelled, with irregular spikes, ribbed, umbonate; surface granulate and chambers narrow. A fine variety of *C. Calcar*, with narrow falciform chambers.

Var. ζ. Pl. 12. figs. *d–f*. "Fossil: Ripalta, near S. Quirico, in the Sienese." Keeled, ribbed, umbonate; last few chambers distorted. *C. cultrata*: a modified individual.

Three varieties (η–ι). "Recent: Adriatic and Mediterranean. Fossil: Coroncina." Var. η. Pl. 12. figs. *g*, *h*. ("Plancus, Conch. p. 12, pl. 1. fig. 3 H.") Keelless, ribbed, umbonate. The most common variety of *C. Calcar* in its less-developed state. The same as *C. rotulata*, *Robulina simplex*, &c.

Var. θ. Pl. 12. figs. *i*, *k*. Keelless, slightly rowelled, ribbed, and umbonate. Like the last, but rowelled.

Var. ι. Pl. 13. figs. *a*, *b*. Keeled, slightly rowelled, bead-ribbed, the granulate septal lines meeting at the umbo. An ornamented variety like vars. γ and δ, but smaller.

Var. κ. Pl. 13. figs. *c*, *d*. "Recent: Mediterranean." Keel slight, with some teeth; ribs faint; no umbo; chambers narrow. A variety of *C. Calcar*, faintly developed as to its several features.

Var. λ. Pl. 13. figs. *e–g*. "Fossil: Coroncina." Slightly keeled, faintly ribbed, umbonate; chambers large. A variety of *C. Calcar*, with large-sized chambers.

Var. μ. Pl. 13. figs. *h*, *i* (*k*, *l*, section). "Recent: Mediterranean. Fossil: Coroncina." Sharply rowelled, faintly ribbed, largely umbonate. The exogenous shell-substance in this variety of *C. Calcar* forms long sharp keel-teeth, and a large umbo.

Cristellaria Calcar, of a symmetrical but limited growth, occurs early in the Secondary deposits, and is often abundant in the clays of the Upper Trias, Lias, Oolites, Gault, and Chalk.

In the Tertiaries it is also abundant, and frequently attains a larger size, and puts on a bolder form of growth. In the recent state it is world-wide,—localities for large specimens being the Canaries, Mediterranean (especially the Adriatic), Norway coast, and the Abrolhos Bank. Bailey has figured it of a large size from the coasts of the United States.

17. Nautilus papillosus. Page 82, pl. 14. figs. *a–c*. "Recent: Adriatic." An elegant variety of *Cristellaria Calcar*, with a small keel and beaded septal lines. It is thick, and has many chambers.

18. Nautilus Vortex. Page 33, pl. 2. figs. *d–i*. "Soldani, Sagg. Oritt. p. 99, pl. 1. fig. 12; Testaceogr. vol. i. p. 66, pl. 59. fig. *t t*." "Fossil: Coroncina." This is a keelless, thick variety of *Cristellaria Calcar*; it has very narrow and much-curved chambers, the septal lines taking a long, curved sweep to reach the margin. There are many gradual intermediate forms between this and the type. It is not unfrequent in clays of the Mediterranean, at about the depth of 90 fathoms; and it occurs fossil in the Tertiary clays of Tuscany, Vienna, and Malaga.

D'Orbigny has given two figures of this variety: that of his *Robulina orbicularis*, Annales Sc. Nat. vol. vii. p. 288, No. 2. pl. 6. figs. 8, 9; and that of his *R. Imperatoria*, For. Foss. Vien. p. 104, pl. 5. figs. 5, 6. The former differs from *Cristellaria Vortex* in having a slight keel, in not being quite so thick, and in being somewhat umbonate. *R. Imperatoria*, having the same amount of keel as *R. orbicularis*, is less gibbous, but more distinctly umbonate than the latter. These slight and almost insensible degrees of modification render the three shells here referred to notable examples of the gradual passage so often recognizable between varietal forms of species. The roundness and plumpness of *Cristellaria Vortex* is modified to the lenticular and comparatively lean *C. Imperatoria*, having markedly contracted chambers (the narrowest of any *Cristellaria*) and a pouting aperture, which is lost in the greater fulness of the chambers of *C. Vortex* and *C. orbicularis*. Full-sized and entire-keeled specimens of *C. Vortex*, supplying still further intermedia, are figured by Soldani.

19. Nautilus costatus. Page 47, pl. 4. figs. *g, h*. "Recent: Mediterranean, Coast of Africa." A *Cristellaria*, more or less keeled; the keel is somewhat toothed; the septal lines are raised or limbate,—a character which, however, is absent in D'Orbigny's figured specimen of a similar variety from the Tertiary beds of Vienna (*Robulina Ariminensis*, For. Foss. Vien. pl. 4. figs. 8, 9); the chamber-walls are regularly marked with numerous ribs at right angles to the septal lines. In this variety of *C. Calcar* (which is not of common occurrence, but sometimes met with in

deposits rich in *Cristellariæ*) we have the link with the Marginuline variety of *Nodosaria Raphanus*, especially in the Viennese specimen, which is narrow-chambered, pinched, and umbilicate, like the crozier-part of a *Marginulina*. This linking is not only shown by the form, the aperture, and the general structure of the shell, but markedly in the style of ornament. The ornamentation of ribs is highly characteristic of the Nodosarine group. In *Nodosariæ* the riblets are often fully and symmetrically developed; in some *Marginulinæ* the rib on the convex border surpasses its fellows; in *Cristellariæ* it is often the only remnant of these ribs; but in some varieties, as in *Robulina echinata*, D'Orb., *R. ornata*, D'Orb., and especially in *R. Ariminensis* and Fichtel's *Nautilus costatus*, the rib-ornament still bears evidence of the relationship mutually borne by these diversely modified forms. Hence one of the grounds for the foundation of the comprehensive genus *Nodosarina**, intended by us to embrace the *Nodosariæ, Cristellariæ*, and all the intermediate and associated varieties. Indeed, we see as yet no essential characters in this protean group whereby more than one real species can be established, although we have examined thousands of forms, not to say individuals, from the Permian, Triassic, Liassic, Oolitic, Cretaceous, and Tertiary deposits, as well as from deep and shallow seas of all parts of the world.

20. Nautilus acut-auricularis. Page 102, pl. 18. figs. *g–i*. "Recent: zoophytic concretions, Mediterranean." A subglobose or ovoid *Cristellaria*, with numerous smooth, narrow, flush chambers, slightly keeled. This is a variety intermediate between *C. Calcar* and Defrance's *Saracenaria Italica*. It is also nearly related to *C. arcuata*, D'Orb. (For. Foss. Vien. pl. 3. figs. 34–36). This appears to be a rather rare and small form. Fichtel and Moll's reference to Soldani, Testaceogr. vol. i. p. 61, pl. 49. fig. *x*, for this form, is correct.

21. Nautilus Crepidula. Page 107, pl. 19. figs. *g–i*. "Recent: Leghorn coast." A delicate, elongate, Marginuline, flattened *Cristellaria*. This variety, which by innumerable linkings passes into *C. Calcar*, is so readily modified by external conditions as perhaps not to be represented by any two perfectly similar individuals. D'Orbigny's *C. cymboides* (For. Foss. Vien. pl. 3. figs. 30, 31) is almost an exact counterpart of Fichtel's figure; but in the former the coil is more open. *C. compressa*, D'Orb. (*loc. cit.* figs. 32, 33), and *C. lanceolata*, D'Orb. (*l. c.* figs. 41, 42), as well as Montfort's "Astacole crepidule," which is Blainville's and Defrance's "Crepiduline astacole" (Dict. Sc. nat. pl. 19. fig. 8), are similar attenuate, but keeled, varieties of *Cristellaria Calcar*.

* Annals, 1859, iii. p. 477.

Cristellaria Crepidula runs insensibly into *C. Cassis* on one hand, and on the other into the Planularian section of the *Vaginulinæ*. It is common wherever *Cristellariæ* are abundant, whether in the fossil or recent state. The specimen figured by Soldani (Testaceogr. vol. i. p. 64, pl. 58. fig. *b b*) is very similar to *N. Crepidula*, as Fichtel and Moll supposed.

22. Nautilus Cassis. Page 95. Five varieties. "Fossil: Coroncina."

α. Pl. 17. figs. *a–d*. Plancus, Conch. p. 120, pl. 1. fig. 11 Q R.
β. Pl. 17. figs. *e–g*. Soldani, Oritt. p. 97, pl. 1. fig. 1 A B C.
γ. Pl. 17. figs. *h, i*.
δ. Pl. 17. figs. *k, l*. Soldani, Testaceogr. vol. i. p. 63, pl. 55. fig. A.
ε. Pl. 18. figs. *a–c*.

We have here some modifications of a varietal form of *Cristellaria*, discoidal and foliaceous, apt to be ornamented by clear granules at the centre and along the septal lines, and to expand itself into a broad and serrate keel.

Individuals of this variety are often pre-eminent among *Cristellariæ* for their size and elegance. Their sinuous and, as it were, loosely-set chambers, their flatness, and the irregular position of the aperture, remove them but a little way from the typical *C. Calcar*. In the var. *ε* the aperture is so nearly central that the chambers grow saddle-shaped, and present us with the essential characteristic of *Flabellina*. Hence the removal of another supposed "generic" limit,—nay, of a "specific" boundary.

Cristellariæ of this shape and size occur in the Italian Subapennine Tertiaries, and also at Malaga in Spain. Individuals of smaller growth abound in some Secondary and Tertiary deposits, and also in recent seas. In the muds dredged off the Abrolhos Bank, in about 30 fathoms water*, we have similar *Cristellariæ*, almost rivalling the Subapennine specimens.

Besides the references to Soldani and Plancus above noted, Fichtel and Moll refer with justice to Soldani (Testaceogr. vol. i. p. 63, pl. 55. figs. A–G, and pl. 56. figs. H–N) for figures of various forms of *Cristellaria Cassis*.

23. Nautilus Galea. Page 100, pl. 18. figs. *d–f*. "Fossil: Coroncina." This is a fine, outspread, extremely flattened, smooth, and broad-keeled *Cristellaria Cassis*, with very widely transverse chambers, the inner extremities of which stretch beyond the spire. In this feature we have an interesting isomorphism, if we may so term it, with other and not related generic forms. This individual, with its attempt at cycloid growth, reminds us of the *Peneroplis planatus*, in its broadest forms, out-

* By Capt. Richards, H.M.S. 'Plumper.'

grown from their short, thick, Dendritine type; and also of that peculiar variety of *Vertebralina striata* in which the later chambers curve round and embrace the earlier spiral portion (*Renulites opercularis*); nor is the mode of growth essentially different in *Orbiculina*, which shows this tendency in *O. adunca* and its varieties, and becomes perfectly cyclical in some individuals,—a feature which is the typical character in *Orbitolites*.

[To be continued.]

XI.—*Note on the Comparative Size of Marine Mollusca in various Latitudes of the European Seas.* By R. M'Andrew, F.R.S.

In the 'Natural History of the European Seas,' by the late Prof. Edward Forbes, edited and continued by Mr. Godwin-Austen, I meet with the following passage, treating of the shells of Piedmont:—" 'It is remarkable,' says Mr. Jeffreys, 'that examples of the same species are smaller than those found in the British seas: *Tellina balaustina, Jeffreysia diaphana*, and *Rissoa pulcherrima* are instances of this.' The diminution in size which is to be observed with respect to many other species, such as *Corbula nucleus*, when traced from north to south, is the more remarkable because the converse does not take place as to southern forms in their range north. *Haliotis tuberculata*, which extends through the whole Lusitanian zone, is larger at Guernsey, which is the extreme northern limit, than elsewhere. *Ringicula auriculata* and *Mactra rugosa* are larger in Vigo Bay than in the Mediterranean, though at Vigo they are both outliers; and *Tellina balaustina*, which has its numerical maximum in the Mediterranean, is largest about the Hebrides."

I do not question the correctness of Mr. Jeffreys's remark applied to the shells collected by him on the coast of Piedmont; but to infer from it, and from the other instances cited by Mr. Austen, that Mollusca generally, or any large proportion of them, whether belonging to northern or southern latitudes, increase in size as they advance northward, and none in a southerly direction, is a grave error, which I feel called upon to dissipate, as far as this end can be accomplished, by a statement of the results of my own experience bearing upon the point; because, in order to advance our knowledge, I look upon it as more essential to get rid of existing fallacies than even to establish new facts.

Corbula nucleus diminishes in size when traced *northward* as well as southward from the British seas, and is as large at Lisbon, or even at Malaga, as upon the shores of North Drontheim.

The size attained by *Haliotis tuberculata* in Guernsey is certainly remarkable; but that it is not owing entirely, if at all, to northern position, may be inferred from the fact that it does not vary in dimensions progressively with the latitude. When inhabiting the coasts of the Bay of Biscay, it is no larger than in the neighbourhood of Gibraltar.

With respect to the *Ringicula* of Vigo, it is questionable whether it is the same species as *R. auriculata* of the Mediterranean, as, in addition to its extra size and solidity, it differs in being destitute of striæ, with which the other is furnished; and Mr. Woodward has suggested the possibility of its identity with a fossil species. If it *should* prove to be *R. auriculata,* the same observation will apply to it as to the *Haliotis,* that the increase in size is not progressive.

Touching *Mactra rugosa,* we require more information with regard to its distribution. In Vigo Bay, dead shells, certainly of large dimensions, are not unfrequent; but, after diligent search, I could never succeed in obtaining a recent specimen there. The other localities from which I have procured the species are Faro in Algarve and Cadiz; one or two stray valves in the Mediterranean, and the same at Mogador. In Faro, where the specimens found on the shore are much more recent than in Vigo, they are nearly, if not quite, as large; while at Cadiz, only thirty miles further south, they are smallest.

The Arctic species belonging to the genera *Trichotropis, Trophon, Margarita,* and *Admete,* with some others, when they extend into the Boreal and Celtic regions, are diminutive. *Pecten Icelandicus* attains its largest dimensions on the coast of Finmark, and is of very diminished size and solidity from Spitzbergen. *Margarita alabastrum* (Boreal) does not appear to vary in size from the North Cape to the seas of Zetland. *Arca raridentata* is generally distributed on the northern coasts of Norway, where it is very much larger than in the Hebrides; and a few specimens which I have obtained as far south as Gibraltar are still more minute. This species inhabits only deep water, which accounts for the extent of its range southward.

Trochus cinerarius and *T. tumidus* have their greatest development in number and size on the northern coasts of Norway, and are found progressively and uniformly smaller as we proceed southward. *Trochus lineatus,* which I have never encountered north of the British Isles, attains its largest dimensions in the neighbourhood of Vigo.

Astarte arctica is as large at Tromsoe, near the southern limit of its range, as in higher latitudes. *A. elliptica* diminishes when traced from Finmark to its southern termination in the British seas. *A. sulcata* attains its maximum on our own coasts, dimi-

nishing in size and frequency as we follow it along the coasts of Nordland and Finmark, as well as to Gibraltar, its most southern locality. The little *A. triangularis* I did not find in northern Scandinavia: it is extremely abundant in some parts of the Hebrides; but, though rare, is of larger size in Gibraltar Bay than I have met with it elsewhere. I take this opportunity of mentioning that I have recorded this species from the Canary Islands; but Mr. Searles Wood, to whom I showed them, believes the Canary specimens (smaller even than the British) to be a different species, and identical with a Crag fossil. *A. incrassata,* a more southern species, is rather larger in the Canaries than in the Mediterranean.

The genus *Crenella* is analogous to that of *Astarte. C. discors* and *C. decussata* attain larger growth and are more abundant in the Arctic and Boreal regions than in the Celtic. *C. marmorata,* which ranges from Finmark to the Canaries, is largest and most frequent on the Scottish coast; while the more southern form, *C. rhombea,* is rather larger in the Canaries and Mediterranean than at the northern limit of its range in the British Channel. So with the genera *Nucula* and *Cardium*; *N. lævis, C. suecicum,* and *C. fasciatum* become smaller as we follow them southward from their principal habitat in northern Scandinavia. *N. nucleus* is as large at Gibraltar as in Finmark, being eminently a Celtic species; while of *N. decussata* my largest specimens are from Malaga; and *C. rusticum* becomes larger as we proceed south from the British Channel, attains its maximum at Gibraltar, and is smallest in the Canaries. *C. papillosum* is also largest in the Mediterranean, though distributed both northward and southward in the Atlantic. *C. pygmæum* is smaller in the Mediterranean than in Britain, but I have obtained it largest in Vigo Bay.

Venus verrucosa, like *Cardium rusticum,* has its northern limit in Britain, increases in size southward to Gibraltar and the Mediterranean, and is again much smaller in the Canaries. *Mactra stultorum* grows to larger size in Minorca than in Britain. Of *Fusus antiquus,* ranging to within the Arctic Circle, the largest specimens have been obtained in Liverpool Bay. *Littorina rudis* attains as large growth upon the coast of the north of Spain as upon that of Finmark. *Scalaria Turtonis* is larger in Britain than in the Mediterranean or at Madeira. *S. communis,* on the contrary, is larger at Gibraltar than in England.

Bulla hydatis is very diminutive in the Mediterranean compared with British specimens; but those from Vigo (situated south of the shores of Piedmont) are fully equal in size to the British or Irish.

Murex erinaceus grows larger upon the coasts of Spain, both north and south, than in Britain. *Cerithium reticulatum* and

C. perversum are likewise larger in the Mediterranean than in our seas. *Triton nodosum* attains greater size at Malaga than at Vigo or further north, but is smallest in the Azores. *Aclis supranitida* grows larger at Madeira than in Britain.

The southern forms of Mollusca appear to follow the same rule as the more northern. *Murex brandaris, Cypræa lurida,* and *C. spurca,* not recorded to have been found north of the Mediterranean, attain larger dimensions in the Canary Islands than in that sea.

There are a few species the larger growth of which appears to be influenced by western longitude or Atlantic exposure. It has been remarked that *Tellina balaustina* is found larger in the Hebrides and on the west of Ireland than in the Mediterranean, where it is much more frequent. I have obtained it at Gibraltar of intermediate size; and a valve dredged off Cape Finisterre in Spain was of the same size as the Scottish and Irish specimens. *Lucina spinifera* is found larger in the Hebrides and west of Ireland than elsewhere; upon the coast of North Drontheim it is quite as small as upon that of Spain. *Solen siliqua, Lutraria elliptica,* and some other species, are found of extraordinary dimensions in the outer Hebrides; several others attain larger growth in Bantry Bay than on any part of the English coast.

From the examples I have stated (and there would be no difficulty in adducing more of a similar character) I think we may fairly come to the conclusion, that, although there are exceptions in both directions, and although the size attained by Mollusca may be influenced by various conditions in different localities, as a general rule, each species attains its greatest size, as well as greatest number, in the latitude best suited to its general development; and that, whether a species be Arctic, Boreal, Celtic, or Lusitanian, it will grow largest in the region to which it belongs.

XII.—*On some new* Longicornia *from the Moluccas.* By Francis P. Pascoe, F.L.S. &c.

In Mr. Wallace's last collection from Batchian, in the Moluccas, there are about one hundred and fifty Longicorns, mostly new to science, but referable (with two or three exceptions) to genera which appear to be more or less frequent in the Indian Islands. The new forms, one of which resembles the South American genus *Onychocerus* in habit, and of which a second species is found in New Guinea (Aru), are confined to Mr. Wallace's private collection, and therefore, unfortunately, cannot now be described; but amongst the others there are a few species which are interesting either as indicating a more extended range of the

genera (as in *Glaucytes*, *Agnia*, and *Cylindropomus*), or as additional members in very limited and remarkable groups, as *Eurycephalus* and *Trihammatus*.

Eurycephalus.

Laporte, An. Art. ii. p. 430.

Eurycephalus variabilis.

E. ater; elytris rugosis, basi plus minusve sanguineis.

Deep black, the upper surface covered with very short erect hairs; head rather broad, thickly punctured; ridge over the insertion of the antennæ, parts about the mouth, and mandibles, except at the apex, blood-red; prothorax coarsely and very thickly punctured, with a short central keel, and a strong tooth on each side, placed behind the middle; elytra irregular, as if roughly punctured, apparently caused by the inequality of the pubescence, the base or base and sides more or less of a blood-red colour; body beneath dull black. Length 10 lines.

Of fifteen specimens examined, no two were quite alike in colour; one was entirely black, and another had rather more than half the elytra red; these were the extremes of the set; and amongst the whole, three had the legs pale red.

Glaucytes.

Thomson, Archives Entomologiques, i. p. 423. *Leptocera*, Serville, *non* Schönherr.

Glaucytes scitulus.

G. niger; prothorace impunctato capiteque griseo-pubescentibus, sericeis; elytris chalybeatis, biapiculatis, maculis quatuor argenteo-albis; femoribus basi testaceis.

Black; head, prothorax, body beneath, and legs covered with a thin, silky, pale greyish pubescence; elytra biapiculate, irregularly punctured, smooth, each with four spots formed of short white hairs, the first before the middle, the second obliquely transverse behind it, then a small round spot, and lastly an oblong one at the apex; prothorax impunctate, rounded at the side; antennæ rather longer than the body, reddish brown; femora at the base testaceous. Length 5 lines.

Agnia.

Newman, Entomol. p. 291.

Agnia eximia.

A. nigra, nitida; capite elytrisque albo-maculatis; prothorace postice

albo-marginato: infra subnitida, marginibus segmentorum abdominis albis.

Deep glossy black; line below the eye, another behind, and one on the vertex, posterior border of the prothorax, scutellum, and several transverse spots on the elytra, pure white (formed by dense patches of short hairs); body beneath and legs black, less glossy than on the upper surface, sparingly covered with a delicate ashy pubescence; margins of the abdominal segments white. Length 10 lines.

This handsome insect is nearly allied to the Philippine *Agnia clara*. *Agnia* differs from *Cereopsius*, principally, in its unarmed prothorax.

Trihammatus.

Chevrolat, Rev. et Mag. de Zool. No. 2. 1857.

Trihammatus tristis.

T. niger, nitidus, subtiliter griseo-pubescens; prothoracis margine antico et vitta suboculari, lateribusque pectoris infra albis; elytris maculis quatuor atris.

Glossy black, covered with a short, dense, greyish pubescence, giving the upper surface a dull leaden hue; head sulcated in front, an oblique yellowish white band beneath the eye, which is continued along the sides of the thorax beneath; prothorax strongly spined on the side, the anterior margin narrowly bordered with yellowish white; scutellum triangular, truncated posteriorly; elytra thickly and irregularly punctured, with several small shining tubercles at the base, and two opake deep-black irregular spots on each (one before, the other behind the middle); antennæ (♂) twice as long as the body. Length 12 lines.

The females of this genus (which have not been hitherto described) differ essentially from the males in the *fourth* joint of the antennæ, only, being enlarged; and this enlargement assumes a cylindrical form, not rounded or pear-shaped, as in the other sex.

Cylindropomus.

Blanchard, Voyage au Pôle Sud, iv. p. 268.

Cylindropomus grammicus.

C. niger; prothorace utrinque vittis duabus albis; elytris fuscescentibus, lineis duabus longitudinalibus, antice posticeque conjunctis, albis.

Dull black; head broader than the prothorax, impunctate, minutely pubescent, a raised line on the vertex and an oblong

white spot behind the eye; prothorax slightly corrugated in the centre, a broad yellowish-white line on each side and a narrower one beneath; scutellum transverse, black; elytra acuminate, finely punctured, pale brown, with two longitudinal whitish lines on each, united at the shoulder and apex; antennæ and legs pitchy, the former nearly three times the length of the body, the femora reddish at the base; body beneath with a greyish pile. Length 7 lines.

Cylindropomus should, I think, be placed in the Lamiidæ, near *Olenocamptus*, from which, indeed, it scarcely differs. A series of this species shows a very considerable amount of variation in the width of the head: in some it is scarcely wider than the prothorax, and from these it runs up to nearly twice the width.

XIII.—*On the Markings of the Diatomaceæ in common use as Test-objects.* By G. C. Wallich, M.D.

The markings on the valves of certain species of Diatoms have long been prized as tests of the defining and amplifying powers of microscopic lenses. Up to a very recent period they answered every purpose; but the rapid advances achieved of late by our leading opticians in the construction of objectives furnish us with many instances in which the formerly received interpretation of minute organic structure has turned out to be fallacious. These tests have thus been somewhat unduly valued, and, as a natural consequence, many indifferent objectives have been thrust on the public, the efficiency of which depended, not on accuracy of construction, but on the variable nature of the tests they were subjected to.

Accuracy of measurement is of the first importance in all microscopic investigations, whether we desire to measure the striæ on a Diatom, the thickness of a cell-wall, a blood-disk, or any of the numberless objects the microscope reveals to us; and until this perfect accuracy is ensured, it is almost needless to say that a vast amount of time and patient labour will be expended in vain.

As an example in point, we need only take the value of *Pleurosigma fasciola*, a Diatom which was considered, until a very late date, as one of the severest tests for a first-rate $\frac{1}{8}$ or $\frac{1}{12}$ objective. It is true that *P. fasciola*, under certain restrictions, may be made an admirable test; but it is one adapted with equal propriety to test either a $\frac{1}{2}$ or a $\frac{1}{12}$ objective. This is due to the widely varying character of its lineation,—a fact of which the less scrupulous class of opticians were not slow to avail

themselves, in order to arrogate for their workmanship a degree of excellence it in nowise merited.

It should be borne in mind that the mere number of lines in any given fractional portion of an inch is not all that is required in a Diatom employed as a test. Much depends on the particular conformation of the Diatomaceous valve—on its thickness, flatness, the angularity of its markings, their direction, the kind of illumination, and so forth. But this only tends still further to diminish the value of such objects as tests, inasmuch as the same form, under different conditions, may or may not be suited to test a given combination.

It is not my province to discuss how much valuable time is often wasted in the endeavour to resolve markings on Diatoms or other minute objects, that might be applied to higher and far more useful purposes. It is well known that many ardent observers labour, for days and even weeks together, in order to conquer some difficulty of the kind,—their toil ending in failure simply because they are unaware that the same species of test-Diatom may present itself under such modifications as to baffle all attempts at resolution in one shape, whilst it may be made to yield readily in another. At present the capabilities of lenses have, too frequently, to be discovered after purchase. They may or they may not come up to the professed standard. The owner may apply an incorrect or an insufficient kind of test; and, under any circumstances, he is unable positively to assure himself of the real power of the apparatus he is using.

Certain Diatoms may still be advantageously employed as test-objects, but assuredly not in the manner hitherto in vogue. In order to ensure uniformity, or, what amounts to the same thing, in order to ensure the purchaser of a lens of a stated power actually obtaining what he desires, it becomes essential that each test-slide should itself be compared with some accredited and universal standard, before being applied to the decision of the capabilities of any optical combination.

I shall endeavour presently to show how likely we are to be misled in our estimate of lenses based upon the resolution of some of the ordinary tests, by giving a tabular statement of the range of lineation admitted to exist by those who have given the greatest amount of attention to the markings on the various test-Diatoms. In dwelling on this topic I have an important purpose in view, namely, the introduction of a definite and uniform standard test, for each grade of objective, in lieu of the indefinite and variable ones that have heretofore been in use.

M. Nobert's test-glasses at once suggest themselves to our notice as likely to afford the requisite standard. We have here a degree of minute workmanship destined for ever to defy the

unaided eye, and demanding the highest of our optical aids to render its nature manifest. These glasses have certainly met with little encouragement in this country; but this depends on no fundamental error either in M. Nobert's principle or his handiwork, but on a minor defect, which will, without doubt, be speedily overcome. I allude to the difficulty of engraving the different series of lines on slips of glass sufficiently thin to admit of their employment under the highest and most delicately adjusted combinations of the microscope. It is universally allowed that the accuracy of the lineation cannot be surpassed, the last and closest series of lines being as regular and distinctly ruled as the first or most distant. The difficulty can hardly be overcome, however, until a separate slip of glass is devoted to each two of the first five or six series, and each one of the remaining number. This would, of course, enhance the cost to a considerable extent; but a truly effective standard would be the result, and we should establish a check upon the fallacious test-objects hitherto resorted to. It must be evident that the more perfect our instruments become, the more urgent is the requirement for an undeviating standard of comparison. When this is known to exist, purchasers of lenses will be provided with a safeguard; and, as a necessary consequence, the efforts to produce improved apparatus will be redoubled.

The subjoined Table gives the lineation of some of the commonly employed test-species, according to the authorities noted in the first column. M. Sollitt's measurements, it will be seen, embrace the extreme ranges. The accuracy of his figures is unquestioned, as regards all but the two last-named forms on the list; and in these it has met with scepticism solely from

Tabular Statement of Lineation in 1000*th of an inch.*

Authorities.	Pleurosigma angulatum.	Pleurosigma fasciola.	Pleurosigma quadratum.	Pleurosigma formosum.	Pleurosigma balticum.	Pleurosigma hippocampus.	Pleurosigma strigosum.	Navicula acus.	Navicula rhomboides.
The 'Synopsis of Brit. Diatomaceæ.'	52	64	45	36	38	Lo. 32 Tr. 40	44		
Carpenter*.........	52	64	...	...	...	Lo. 30 Tr. 40	44	...	85
Micrographic Dictionary.	52	64	45	36	38	Lo. 30 Tr. 40	45	125·130	85
Sollitt†	46·51	50·90	35·60	20·32	20·40	40·45	40·80	120·130	60·111

* 'The Microscope,' by Prof. Carpenter, p. 205.

† Quarterly Journal Microscop. Science, No. 29, p. 51.

the extreme difficulty of counting lines so delicate, even granting them to be visible under the lens. Accepting the measurements as approximately correct, it is apparent that a series of markings, the variation of which, in the several species, ranges from about 5 to 50 per cent., ought no longer to be received as affording standard tests or specific characters.

I have stated that the hitherto received interpretation of various structures, as seen under the microscope, has in many cases turned out to be inaccurate, owing to the improved means of observation at our command. I would draw attention more especially to one of the most valuable, inasmuch as it is the most constant in its lineation, of all our test-Diatoms, viz. *P. angulatum*. It is well known that, under the generally adopted view, the markings consist of hexagonal *depressions* on the surface of the valve. Not only has this interpretation been insisted on by all our chief authorities, but its accuracy has been made to appear unimpeachable on the evidence afforded by a photographic image. Facts are stubborn things to contend against; and in an endeavour to correct an impression based on such apparently incontrovertible testimony I am painfully aware that I have a hazardous task to perform.

Professor Carpenter ('The Microscope,' p. 304) writes as follows :—

"In the first place it may be remarked, that there is a much greater uniformity in the general character of these markings than was supposed when attention was first directed towards them; for what were at first supposed to be *lines* are now resolved by objectives of large angular aperture into *rows of dots*; and these dots, when sufficiently magnified, are found to bear a close resemblance to the coarser markings on the larger species. It is to the latter, therefore, that we should have recourse for the determination of the nature of these markings; and we cannot resort to better illustrations than those that are afforded by *Isthmia, Triceratium,* and *Biddulphia,* in all of which the structure of the valve can be distinctly seen under a low magnifying power, and with ordinary light." After proceeding to show that the markings, in each of these instances, consist of a number of areolar depressions, he continues: "Now, it would not be difficult to bring together a connected series of Diatomaceæ in which the markings, still exhibiting the same general aspect, become more and more minute, requiring for their resolution the use of oblique light, or stops with a central diaphragm, and of objectives of larger and larger angular aperture, until we come to those species which present the greatest difficulty, and the nature of whose markings seems to be most obscure. The more perfectly these markings are defined, however, in any

case, the more decidedly are they found to correspond with what has been already seen. Thus, if we examine *Pleurosigma angulatum* (one of the easier tests) with an objective of $\frac{1}{4}$ inch focus and 75° aperture, we shall see a double series of interrupted lines, crossing each other at an angle of 60°, so as to have between them imperfectly defined lozenge-shaped spaces. When, however, the valve is examined with an objective of $\frac{1}{12}$ inch focus, having an angular aperture of 130°, and is illuminated by oblique rays, the hexagonal areolation becomes very distinct; and if a photographic representation obtained by such a power be itself enlarged by photography, as has been accomplished by Mr. Wenham, the appearance represented (by the diagram, *loc. cit.*) is obtained, which is in all respects comparable with that presented under a low power by the valve of *Triceratium* or *Isthmia*."

In the 'Micrographic Dictionary' we find observations nearly to the same effect. But a remarkable paragraph occurs at page 221 (new ed.), in the article "Diatomaceæ." After denoting the varying phases a Diatomaceous valve may be made to assume under different powers and modes of illumination, it thus concludes:—"If the condenser and stop be not exactly centrical, or the surface of the valve be not flat, the true form of the dots will be replaced by some other: thus hexagonal dots may be made to appear triangular, quadrangular, &c., and those dots which cannot be conceived to be really hexagonal may be made to appear so,"—*Pleurosigma balticum* being here referred to amongst the figures.

I duly appreciate the difficulty of having to deal with statements supported by such unquestionably high authority,—more particularly when they seem to carry with them the proof derived from the photographic art. But the latter testimony appears to me by far the most assailable, and I have adduced the paragraph just quoted in support of my assertion. For if, by modification in the focussing of a valve, hexagonal dots may be made to appear triangular or quadrangular, and those dots which cannot be conceived to be really hexagonal may be made to appear so, it follows that by similar modification under the photographic appendage to the microscope, these figures may be respectively reproduced according to the fancy of the operator.

Although the evidence derived from a photographic picture may safely be relied on under ordinary circumstances, it at once loses its value in the case before us, the image thrown on the prepared plate or paper being of necessity identical with that impressed upon the eye of the observer when adjusting the object to be depicted, and whatever he sees being, as a matter of course, reproduced in the photographic picture.

Now, every authority with whom I am acquainted starts off by admitting as an axiom that the lower the power under which the structure of any object can be made evident, the less chance is there of error. To dispute this would be absurd. The same authorities admit, moreover, that under a moderate power (say of from 300 to 500 diameters) the lineation of *P. angulatum* appears in the form of obliquely or diagonally arranged lines, placed at an angle of about 60° with the transverse section of the valve, and enclosing "lozenge-shaped" spaces between their intersections. And, strange to say, in some of our most elaborate works, the greatest pains appear to have been taken to show the beautifully defined character of these lines, under the powers just indicated, even to the extent of employing specially prepared polished paper for the engravings which represent it.

Analogy has been pushed a little too far in this instance. There are cogent reasons, open to every observer of the Diatomaceæ, why we ought not to expect the same markings in the Naviculoid as in the discoidal and allied forms. It would be vain, for example, to endeavour to reduce such as are found on *Surirella* or *Pinnularia* to the same category as those of *Isthmia*, *Biddulphia*, or *Triceratium*. No forms can be more distinct in this respect than these last named. Their typical structure, as observed in *T. favus*, consists of *depressed* spaces, which vary from true hexagons in their horizontal section to somewhat irregular figures, such as we find in *Eupodiscus Argus* and *Isthmia enervis*, where, in addition to mere irregularity in outline, the walls of the depressed spaces are studded with minute projections, giving them a ragged appearance under sufficiently high magnifying power. In pressing either of these into our service, therefore, simply because they are of dimensions large enough to be most readily dealt with, a serious error has, in my humble estimation, been committed. But it is a remarkable fact that *T. favus* actually supplies us with markings strikingly similar to those of *P. angulatum*, not on its valves, but on its connecting zones. A very little care is requisite, in the case of the larger varieties, to show that the markings of this portion of the frustule are, as in the case of *P. angulatum*, *diamond-shaped elevations*, each of which presents four clearly defined facets, inclined to the surface of the valve at an angle probably of about 25°, and yields, therefore, four distinct series of lines, two of which, the diagonal, are most clearly marked, for reasons presently to be given; whereas the other two series (namely, the transverse and longitudinal) are more nearly approximated to each other, and much less palpable.

In using direct light, either with or without an illuminating combination, for the resolution of these markings, it is almost

impossible to succeed. If we look upon an ordinary plano-convex condensing lens, placed at a distance from the eye, in the direct line of the source of light, provided no objects present themselves in the background, the convexity is inappreciable. The moment, however, that an angle is formed by the rays, the convex character strikes us. And so with objects exhibiting angular facets, although in a less easily demonstrable degree, owing to the impossibility of receiving several sets of rays, each parallel to one series of facets. Under the microscope, the same principle holds good: facets are never seen by *strictly* direct light. The mere placing the axis of the instrument in a line with the source of light by no means fulfils this condition. In viewing transparent objects, and more especially objects of such high refractive power as the valves of the Diatomaceæ, oblique light must be engendered. We must in this instance court shadows as our only means of grasping the reality. To exhibit these much coveted "*dots*," shadows are still indispensable, but here they are imperfect ones*. The greater the obliquity of the illuminating rays, *so long as definition remains perfectly clear and free from coloured spectra*, the greater will be the distinctness with which the true character of markings will be seen. Unless they are thus distinctly seen, appearances must prove deceptive, and even the photographic picture may err *in modo*.

In a valuable paper "On Species of Diatomaceæ," under the signature of one of our first authorities (Professor Walker-Arnott, Journal Microscop. Science, vol. vi. p. 200), the following passage occurs:—

"But as all Diatoms, with striæ composed of dots, have four rows of striæ (two diagonal, one horizontal, and one longitudinal), and as the visibility of each depends, when delicate, on the position the valve presents to the illuminating pencil of oblique light, the closer or more difficult striæ are sometimes seen when the others are not, and thus may be occasionally mistaken for the predominating or coarser ones, which alone are made use of in specific characters. I may here remark that, when the dots are so placed as to form rectangles, the transverse and longitudinal striæ are always the most remote, and therefore predominate; and it is generally supposed that when the dots are quincuncial, the diagonal lines are always most apparent; but

* In a paper by Hugo von Mohl (in the December Number of the Annals and Magazine of Nat. History, p. 444) the author is at pains to prove that polarized light has been neglected heretofore in microscopic examinations; and, in proof of the advantages to be derived from its employment under scientific adjustment and management, he states that the markings on *Pleurosigma angulatum* may actually be shown to consist of "*six-sided dots*."

this conclusion is not correct: for when the diagonal lines make, with the transverse, an angle greater than 60°, the transverse rows are more remote than the diagonal; and when the angle is less than 30°, the longitudinal rows are the more remote, and easily detected. In the quincuncial structure, therefore, the diagonal lines predominate only when the angle of inclination is more than 30° and less than 60°; but the transverse and longitudinal cannot both preponderate in the same species."

I have therefore the satisfaction of believing that my view is borne out, as far as the number of series of lines is concerned, by one so competent to guide our judgment. The cause of the predominance of the diagonal lines in *P. angulatum* and the rectangular in *P. balticum* is thus made apparent to a certain extent. But it will be observed that Professor Arnott evidently considers the whole four series of lines as occurring upon the same plane, the word "distant" bearing reference clearly to the position of the lines as removed more or less from each other on that plane, and the theory offered being, that the more distant series of lines are most distinct, whereas the most closely approximated are the reverse.

Both as regards *P. angulatum*, *P. hippocampus*, and their allied forms, the diagonal series of lines consist of alternate ascents and descents along the angular edges of the raised facets, which thus constitute a series of zigzag lines directly in the line of vision, whereby they cannot be brought simultaneously into focus at all points. In short, every portion of the two series of lines which bound the elevations is arranged on the same plane, whilst the lines which unite the facets are not so.

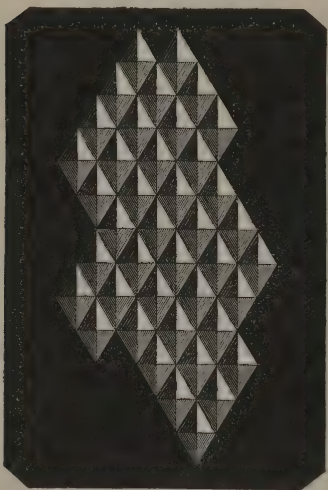
In *P. formosum* and *P. quadratum* the structure is analogous to that existing in *P. angulatum*. In *P. balticum* and *P. hippocampus*, instead of diamond-shaped elevations, we have four-sided flattened pyramids, presenting, as in the former case, four sets of lines; but here, as a natural consequence, the spaces being bound by the longitudinal and transverse series, these predominate.

This is in accordance, moreover, with the lines of fracture observable in both types,—a fragment of *P. angulatum*, for instance, always having its edges defined in conformity with the diagonal lines bounding the diamond-shaped elevations; whereas in *P. balticum* the edges follow the rectangular outline of the boundary lines. In both examples, the lines of fracture occur at the *thinnest* portions of the valves. No such lines of fracture occur in *Triceratium*, *Isthmia*, or *Biddulphia*. Of course, according as we view these objects on their external or internal aspects, the eye receives the impression of elevations or depressions, the markings—*i. e.* the elevated angular spaces—being confined to

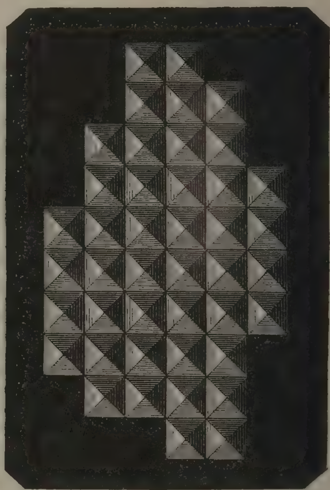
the exterior surface. The "diamond pattern" often seen on household ware of cut glass will at once serve to illustrate the kind of structure in question.

Lastly, whilst we have *four* series of lines in all the Diatoms just alluded to, we have only *three* in such as exhibit true hexagonal areolation; and we cannot, under any modification of light, or adjustment, or magnifying power, convert these six-sided spaces, *so long as they remain clearly defined,* into diagonal or any other kind of lines. Whensoever appearances present themselves under the microscope which are known not to represent the true structure or markings of an object, we may rely upon it that either the instrument or its adjustments are at fault. With perfect objectives and proper adjustments, these spurious appearances cannot occur.

The subjoined admirable woodcuts illustrate, in an exact manner, the structure of the two typical forms, *P. angulatum* and *P. balticum*; and it will be observed that, even on the plane surface of the paper, by altering the position of the figures with



Structure of *Pleurosigma angulatum.*



Structure of *Pleurosigma balticum.*

reference to the source of light, the appearance of elevations or depressions may be imparted to the facets at pleasure. Under proper management, this structure may be made apparent, with equal clearness and definition, either by means of a $\frac{1}{4}$ inch or $\frac{1}{12}$ inch aperture.

XIV.—*Note in answer to* Mr. Clark's *Remarks on* Lepton sulcatulum. By J. Gwyn Jeffreys, Esq., F.R.S.

To the Editors of the Annals of Natural History.

Gentlemen,

I cannot agree with Mr. Clark in supposing that *Lepton sulcatulum* is the fry of *Circe minima*. I have now before me no less than 49 perfect specimens (some of which retain the remains of the animal) and 332 single valves of the former species. They constitute a perfect series from the fry to the adult. I have placed in juxtaposition with them a complete series of *Circe minima* obtained from the same locality (Guernsey), three of the latter being considerably smaller than the average size of *Lepton sulcatulum*. Each series differs widely from the other in respect of form, texture, dentition, and position of the ligament. The fry of *Circe minima* is gibbous, of a triangular shape, remarkably solid for its size, with its beaks strongly incurved, and a distinct lunule under them; and it possesses an *external* ligament and the peculiar dentition of the *Cyprinidæ*. The *Lepton sulcatulum*, on the contrary, is somewhat compressed, nearly round in outline, semitransparent, with its beaks calyculated (as in the other species of *Lepton*), and it has an *internal* ligament and the unmistakeable dentition of the *Kelliadæ*. Even in the most minute *Circe minima* the coloured spots and markings which adorn the adult are observable; while the other is white and spotless. The number of ridges, too, on the first are not half so numerous as those on *Lepton sulcatulum*, and they are disposed in a very different way. Owing to the ligament in *Lepton* being internal, the valves become easily separated; and this accounts for the comparatively small proportion of perfect specimens which are usually met with. I request your readers to take the trouble of comparing the excellent figures of the hinge in *Lepton sulcatulum* (from a drawing kindly furnished by my friend Dr. Lukis) in the 'Annals' ser. 3. vol. iii. pl. 2. f. *c, d, e, f*, with those of *Circe minima* in the 'British Mollusca,' vol. iv. pl. 26. f. 4, and I think they will at once be satisfied that I have not erred in considering these species to be distinct.

Before I described *Lepton sulcatulum* in the 'Annals,' I had the advantage of a correspondence with Mr. Clark on the subject, in which he at first pronounced the shells I sent him, as belonging to a new species, to be successively *Lucina borealis*, *L. leucoma*, *L. spinifera*, and *Venus casina*; but afterwards he candidly admitted that "beyond all dispute" it was a *Lepton*, and allied to *L. Clarkiæ*. His observations on the last occasion were extremely valuable and interesting, especially as to the

calyculation of the beaks, the internal ligament, and the dentition. I am not, however, surprised at the difficulty of distinguishing these tiny objects without a patient comparison with others of a similar kind.

If Mr. Clark has found the *Lepton sulcatulum* at Exmouth (which does not clearly appear from his last paper), the new locality should be noted.

I am, Gentlemen,
Yours faithfully,
J. Gwyn Jeffreys.

25 Devonshire Place, London,
January 20, 1860.

BIBLIOGRAPHICAL NOTICE.

On the Origin of Species by means of Natural Selection; *or, the Preservation of Favoured Races in the Struggle for Life.*—By Charles Darwin, M.A., F.R.S., F.G.S., &c. London, 1859.

To endeavour to understand the various "beginnings" of the organic world is so essentially the part of an inductive, inquiring mind, like that of the distinguished naturalist who has lately given us the remarkable volume bearing the above title, that no amount of failure in the attempt to do so can check the inherent desire that we possess to renew our efforts, again and again, to discover them. Yet, in spite of this, no trains of reasoning have ever yet brought us, and none with which we are acquainted, we may safely add, ever *can* bring us, to the absolute origin of the present order of things, and unfold to us (what perhaps it was never intended that we should know) the mysteries of creation. "We cannot in any of the palæontological sciences," says Dr. Whewell, "ascend to a beginning which is of the same nature as the existing cause of events, and which depends upon causes that are still in operation. Philosophers never have demonstrated, and probably never will be able to demonstrate, what was the original condition of the solar system, of the earth, of the vegetable and animal worlds, of languages, of arts. On all these subjects the course of investigation, followed backwards as far as our materials allow us to pursue it, ends at last in an impenetrable gloom. We strain our eyes in vain when we try, by our natural faculties, to discern an origin."

When we look abroad into the world around us, we find ourselves in the midst of a variety of phenomena, and an endless array of organic forms, all circling onwards, yet never, so far as we can see, altering in aspect; so that, from the light of mere nature alone, there seems no reason why they should not go on for ever,—

> "Still changing, yet unchanged, still doomed to feel
> Endless mutation in perpetual rest."

Neither, on the same grounds, would it appear necessary to believe that they had ever *commenced*, did not geology inform us that there was a time in the world's history when they did not exist, but were

replaced by another class of beings which occupied their places; and that this latter set was, at a far earlier age, represented by another; and this, again, by an older one still; and so on, until we seem to reach at length the primordial beings with which this planet was originally stocked. It is to discuss, and to *account for*, this succession of beings throughout time and space that Mr. Darwin's book has been compiled; and the great principle by which he believes them all to have been successively produced he terms "Natural Selection."

The opinion amongst naturalists that species were independently created, and have not been transmitted one from the other, has been hitherto so general that we might almost call it an axiom. True it is that we cannot prove this; but then, on the other hand, we cannot prove the converse; and, since of two unproveable propositions we have a right to take our choice, the former has been universally accepted, as most in accordance with the intelligible announcements of revelation, and as aiding us in the otherwise hopeless task of understanding what a species really is. This proposition Mr. Darwin boldly calls in question, and believes, on the contrary, that all species (man included) may have been derived, each in its turn, from those below them by the mere "selecting power of nature,"—which is supposed to have been continually at work, through countless ages, in rejecting (by inevitable annihilation) the weakest and most ill-developed individuals which everywhere existed, and in preserving every little modification which chanced from time to time (in the "great struggle for life" which has ever been going on amongst organic beings) to turn out *for the benefit* of its possessor, and transmitting it, by the law of inheritance, to the next generation, to be further increased in the same direction, until, at length, in the course of centuries, the various races have each become so far modified in structure (and that, too, *intermittently*, or, as it were, *en route*, according to their position, or advancement, in the animal pedigree) as to have assumed the various forms, past and present, which naturalists have described under the name of "species." The fossils of each geological formation, on this view, "do not mark a new and complete act of creation, but only an occasional scene, taken almost at hazard, in a slowly-changing drama" (p. 315); and "the fact of the fossil remains of each formation being in some degree intermediate in character between the fossils in the formations above and below is simply explained by their intermediate position in the chain of descent" (p. 476).

Now, whether right or wrong in their assumption, and however much they may differ in their exact definitions, it is quite evident that there is an *idea* involved by naturalists in the term "species" which is altogether distinct from the fact (important though it be) of mere outward resemblance,—viz. the notion of blood-relationship acquired by all the individuals composing it, through a direct line of descent from a common ancestor; and therefore it is no sign of metaphysical clearness when our author (p. 51) refuses to acknowledge any kind of difference between "genera," "species," and "varieties," except one of *degree*. *Practically*, no doubt, the differences, as we

define them, are entirely, and must be, of this nature, for we are necessarily driven to form our judgment solely from outward characters (and must often trust, as it were, to chance, that our decision, thus arrived at, is correct); so that it is quite possible (nay, almost certain) that what one naturalist may rank as a species, another may perhaps, occasionally, believe to be only a variety: nevertheless the *idea involved* in the two terms is not invalidated on that account; and it is simply taking advantage of the imperfections of our discernment (whilst compelled to conjecture from the mere characters which are externally visible), to throw discredit on a distinction between essentially different *ideas*. Man may blunder (and we have but too clear evidence that he often does); but that cannot make nature inconsistent.

There is one point, however, according to Mr. Darwin's own confession, which has struck him much: viz. that all those persons who have most closely investigated particular groups of animals and plants, with whom he has ever conversed, or whose treatises he has read, are firmly convinced that each of the well-marked forms was at the first independently created. But, says he, the explanation of this is simple: from long-continued study they are thoroughly impressed with the distinctions between the several races, and they ignore all general arguments,—refusing "to sum up in their minds slight differences accumulated during many successive generations." But is this more, we may ask, than special pleading? If anybody is capable of forming an opinion on the origin of species, it surely must be those who have most closely studied them; for, if otherwise, we should arrive at the monstrous conclusion that, in order to generalize well, it is desirable to have only a superficial knowledge of the objects generalized upon!—a conclusion to which our learned and amiable author, we feel sure, would not subscribe. The true explanation seems to be this: not that the study of small details unfits an observer for wider areas of thought, but simply that a generalizing mind is of a higher stamp, and therefore less common, than one of an opposite tendency; so that there are more *collectors* in the world than generalizers. But to suppose the accurate study of minutiæ to be detrimental to an enlarged interpretation of their results is certainly contrary to experience.

But let us briefly examine the argument of this volume, and see how it is sustained. In the first chapter, Mr. Darwin ably discusses the question of the variation of certain animals and plants under domestication; and few have paid greater attention to this subject than he has, or been more successful in their experiments. A close study of the varieties (acknowledged as such by all) of the domestic pigeon, the innumerable races of our common cattle, and also of what gardeners term "sporting plants," has long convinced him, as well indeed it might, of the almost endless phases which may be gradually shaped out by the selecting power of man. This will be admitted by all, and by none more readily than by those who believe in the distinct origin of species; for, as no two species are alike, it follows that the constitutions of all are different; and if their number, there-

fore, be infinite, so will, likewise, be the degrees of their pliability. Hence, if it should have happened (whether from chance, or, which is more probable, from actual selection, after experiment) that the most plastic organisms have been operated upon, we cannot marvel at the results, however extraordinary. But that equal variations are never brought about in creatures of a less flexible temperament, is abundantly shown (by Mr. Darwin's own admission) in the case of such animals as the cat, donkey, goose, peacock, guineafowl, &c., which apparently, although so universally bred and domesticated, have not altered in the slightest degree in the course of time. Mr. Darwin explains this fact by supposing (p. 42) that the principle of selection has not been brought to bear upon them. But, if selection, "*unconscious*" as well as "methodical," has been going on to the extent believed, we cannot see why it should not also have silently acted, at any rate to a certain extent, in such cases as these, no less than in the others. To our mind the answer is plain: viz. that the species in question are by nature unpliant (like the great mass of animals), and therefore have not made any progress from their original starting-points.

But let us admit, for the sake of argument, that man, as an active, living agent, and therefore as an intelligent, efficient cause, capable of directing his experiments, and bringing judgment, taste, energy and intellect to bear upon them, possesses the power of altering, in the course of time, the external features (even though they be usually unimportant ones) of nearly *all* the organisms, animal and vegetable, on which he may systematically operate: let us admit this (for we do not wish to be unnecessarily sceptical); and then let us discuss the question, whether there is any principle in nature analogous to this selecting power of man; for, if there is, why should not similar modifications be produced even in the external world? Mr. Darwin believes that there is such a principle; and his second chapter is consequently devoted to what (as we have already stated) he calls "Natural Selection."

The rate at which all organisms would naturally multiply, if unopposed by external checks, is perfectly enormous. The elephant, the slowest breeder of all known animals, would in 500 years, says Mr. Darwin, produce fifteen million elephants, descended from a single pair. There is no exception to the rule that every organic being naturally increases at so high a rate that, if not destroyed, there literally, in a few centuries, would not be standing-room on the earth for its progeny! Hence arises the certain fact that more individuals must be destroyed annually than are born, and that therefore there must be a constant warfare going on amongst living beings, and, as a consequence, a general struggle for life: and in this battle it is reasonable to suppose that the most gifted, or fully developed, individual, each of its kind, would have the best chance of success and (through having survived) of begetting offspring,—which offspring would probably inherit, to some extent, the advantages of their parents, and would in their turn increase these advantages, and give birth to a still more highly gifted progeny; and so on (it is urged) *to an unlimited extent.*

Now, when not pressed too far, so as to become ridiculous, there is a speciousness, nay even a probability, about this theory to which most naturalists would readily give assent. Although unquestionably a mere theory, and incapable of proof when applied to the greater portion of the feral world, there is a reasonableness about it which at once commands our respect. It enables us to account for many a trifling variation which, because permanent, naturalists have usually regarded as of necessity aboriginally distinct, and smooths down some of the minor controversies concerning the value of minute modifications which may be properly referred to direct agencies from without. Indeed we will go a step further, and affirm that there is no reason why *varieties*, strictly so called (though too often, we fear, mistaken for species), and also geographical "sub-species," may not be gradually brought about, even *as a general rule*, by this process of "natural selection:" but this, unfortunately, expresses the limits between which we can imagine the law to operate, and which any evidence, fairly deduced from facts, would seem to justify: it is Mr. Darwin's fault that he presses his theory too far. The mere fact of any such varieties thus matured (if they do indeed exist in nature) being apt to be at times mistaken by naturalists for true species, is surely no argument against the genuineness of the latter: it merely shows the imperfection of our limited judgment, and that the best observers are liable to err, and either not to catch the true characters of a species intuitively (which, in point of fact, they could scarcely be expected to do), or else to assign at times undue importance to differences which they may afterwards detect not to be in reality specific.

We must candidly admit, however, that Mr. Darwin is most consistent to his principles; and for this we would give him every credit: for if he objects to the inconsistency of "several eminent naturalists," in the "strange conclusion which they have lately arrived at," that certain species have been created independently, whilst they deny the fact that a multitude of *formerly reputed* species are in the same category (p. 482), we might fairly take him on his own grounds, and cavil at his conviction (p. 484) "that all animals have descended from the, at most, only four or five progenitors, and plants from an equal or less number," and contend that he is bound to advance even still further than this, seeing that he objects to the existence of a limit simply *because we cannot* (by the nature of the case, for, *in its entirety*, it is not a "truth of sense") *strictly define it*, or (in our short-sightedness and stupidity) are apt to blunder and oftentimes to mistake its position. But he cleverly anticipates this objection (and a very serious one, for him, it would have been) by nipping it in the bud: "Analogy," he says, "would lead me one step further, viz. to the belief that all animals and plants have descended from some one prototype." "Therefore I should infer, from analogy, that probably all the organic beings [*i. e.* animals as well as plants] which have ever lived on this earth have descended from some one primordial form into which life was first breathed" (p. 484). This is plain language, at any rate!

But, having said a few words on the narrowness of the limits within which we can honestly conceive this ingenious fancy to be applicable, we might call attention to many other considerations arising out of it, did space permit. To our mind indeed the whole theory of "natural selection" is far too utilitarian, and its importance immensely overrated. "An extraordinary amount of modification," says Mr. Darwin, "implies an unusually large and long-continued amount of variability, which has been continually accumulated, by natural selection, *for the benefit of the species*" (p. 153); but surely every naturalist must, in his own province, have observed that a vast number of "modifications" have apparently no reference whatsoever to the "good," or advancement, of the species (a fact indeed which has not altogether escaped, *teste* p. 90, our author's sagacious ken), but are often merely, as it were, fantastic, or grotesque, having no connexion with either its well-being or mode of life, and the final cause of which it is utterly hopeless to discuss. Moreover, some of these "developments" (so called) seem merely given for the adornment or elegance of the creature, and frequently display an arrangement of colouring which nothing but an actual intelligence could have planned, and which therefore no amount of mere chance "selection" by an imaginary agent called "nature" can be supposed to have effected. Nor can such characters be referred to what our author would call "sexual selection," seeing that, in the majority of instances, they pertain to both males and females. Neither can they be due to "correlation of growth;" for we cannot conceive that such marvellous perfection of painting as, for instance, the tints of certain butterflies (which are blended together with such nicety and consummate skill, in accordance with the laws of colouring, as to surpass an artist's touch) could have been brought about through mere correlation with a change in some other part of the organism. Such cases bespeak thought, imagination, and judgment, all and each of the highest stamp, and are utterly inexplicable on any of the three principles above alluded to.

Besides, to make "nature" accomplish anything requiring intelligence and foresight, and other attributes of mind, is nothing more or less than to personify an abstraction, and must be regarded therefore as in the highest degree unphilosophical. We believe it was Coleridge who first called attention to this fact, that to treat a mere abstraction as an efficient cause is simply absurd. But that this is the plain and undoubted tendency of our modern materialists, the following sentence, taken at random from the present volume, will certainly go far to corroborate: "As man can produce, and certainly has produced, a great result by his methodical and unconscious means of selection, what may not *nature* effect? Man can act only on external and visible characters: *nature* cares nothing for appearances, except in so far as they may be useful to any being. *She* can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life. Man selects only for his own good; *Nature* only for that of the being which *she* tends. Every selected

character is fully exercised by *her*; and the being is placed under well-suited conditions of life" (p. 83).

But who is this "Nature," we have a right to ask, who has such tremendous power, and to whose efficiency such marvellous performances are ascribed? What are her image and attributes, when dragged from her wordy lurking-place? Is she aught but a pestilent abstraction, like dust cast into our eyes to obscure the workings of an Intelligent First Cause of all?

Although it is quite possible that there may be a final cause for every thing, and every character of a thing, in nature (in the same sense as one of our acutest metaphysicians has contended that religion is the final cause of the human mind), we should nevertheless be exceedingly reluctant to press this doctrine too far, for all experience warns us that it may become an impediment, rather than a help, to the progress of scientific discovery. Yet it is one thing to give it more than its due, another to reject it altogether: and those who, like our author, prefer being shipwrecked bodily on the rocks of Scylla to running the slightest risk from the opposite Charybdis, need but to be reminded that a proper use of it has been as fruitful in guiding the researches of our greatest physiologists as the abuse of it has been instrumental in perverting them. And we may confidently affirm that Bacon's famous censure on the "barrenness" of these "vestal virgins" (which was applied, be it remembered, to *physics only*, and which has been made so much of by the advocates for the sufficiency of secondary causes in the organic world) would have been less severe "could he have prophetically anticipated," as Sedgwick has well remarked, "the modern discoveries in physiology."

But, before dismissing these immediate considerations, we must say a word or two on the fact of "individual variability," which we cannot but think has been made too much of throughout the volume before us. Without it, "natural selection" would be of course impossible—that is evident; but is its *presence* sufficiently significant to render the theory in any degree *probable*? This is the question with which we are now concerned. Mr. Darwin says that it is only necessary for an individual to vary, be it ever so little, for the principle of natural selection to be established; but to us it seems almost incredible that the general "struggle for existence," or even the extreme pressure of peculiar circumstances from without, should find in mere "individual variability" a sufficient *primum mobile* to lay the foundation of a series of after-divergences (in a given, undeviating direction) destined, each, to accumulate, by infinitesimal degrees, into such successive, intermittent, well-marked forms as to merit, at each stage, the rank of "species." For "individual variability" (so called) is scarcely more, after all, than one of the many proofs, or indices, of individuality; so that to assert its *existence* is simply to state a truism. Amongst the millions of people who have been born into the world, we are certain that no two have ever been *precisely* alike in *every* respect; and, in a similar manner, it is not too much to affirm the same of all living creatures (however alike some of them may seem to our uneducated eyes) that have ever existed. We

cannot demonstrate this, undoubtedly, for it is not a truth of *sense*; but it is a truth, nevertheless, of the highest reason (founded on a limited experience), which a reflecting mind will at once receive without evidence; and it may therefore be almost regarded as an axiom. But what does this fact (self-evident as it is) indicate, except this: that, whilst "individual variation" (in each species) is literally endless, it is at the same time strictly prescribed within its proper morphotic limits (as regulated by its specific range), even though *we may be totally unable to define their bounds*? For, if otherwise, how could it happen that, whilst individually different *ad infinitum*, they are nevertheless (in many species) so alike in the mass as to appear to our rough judgment absolutely identical? Hence, we cannot regard "individual variability" as a phenomenon of any real importance or signification, but simply as a *fact* almost involved, as it were, in our very notions of individuality; for, if ever there was a truth more certain than another, it is this: that "there is no similitude in nature that owneth not also to a difference."

But, although we cannot honestly believe, except to a very limited extent, in this "natural selection" theory, as being directly opposed to the doctrine of Efficient Causation (which involves the conception of intelligence, free-agency, and will), as excluding even the idea of creative foresight from the natural world, and so rendering final causes both absurd and impossible, and, moreover, as built chiefly upon negative evidence, and unsupported by the majority of *facts*, still we by no means wish to imply that Mr. Darwin's volume (so full, as it is, of bold hypotheses and philosophical suggestions) is not a most valuable and important fund of knowledge, but, on the contrary, that it will doubtless prove a solid and lasting contribution to science, as one which will inevitably direct a mass of future observations into a new channel; for to leave an opposite impression would be the deepest act of ingratitude on our part for the great profit that we have derived from the careful perusal of its contents. His remarks on geographical distribution (a subject which he has so long and so carefully studied) are most instructive and admirable, and will supply an explanation for many an obscure and puzzling fact which has so often perplexed observers, concerning the appearance of similar and closely allied forms in regions far removed from each other. Especially interesting, too, is the whole of his Section on "Dispersal during the Glacial Period," from which we should be tempted to quote largely did space permit. But as such is unfortunately wanting, we must leave this subject, as well as the entire portion concerning the geological succession and the imperfections of its record, altogether unglanced at. He states his difficulties with honesty, precision, and clearness, and sometimes (as it appears to us) even exposes them more than is necessary—to his own disadvantage: but we wish that we could add that, in spite of this candour on his part (a candour which is so manly and outspoken as almost to "cover a multitude of sins"), we thought *any* of them satisfactorily replied to. There is a clever and ingenious pleading for them all; but, if we look back into the volume, we find (to use the mildest expression) that each, in its turn, has been

left in doubt—awaiting further evidence. So that, until this is forthcoming, we cannot but feel that, whilst the theories are in one direction (and made to dovetail into each other), the great body of facts is unquestionably on the opposite side. More especially will this apply to that gravest of all objections (as Mr. Darwin frankly admits), *the thorough and complete absence* (both in geological collections, imperfect though they be, and those, extensive and endless as they are, of the Recent Period) of that countless host of transitional links which, on the "natural selection" theory, must certainly have existed at one period or another of the world's history. They *may* be forthcoming some day; we cannot tell (and so, truly, may many other things, after the same fashion of reasoning!): but at present it is absolutely certain that we have not so much as a shadow of evidence either that they do exist or have ever existed. On whichever side we turn we find order and symmetry to be the law of creation, instead of confusion and disorder. To an uneducated eye, which views things only in the mass, this may not appear *primâ facie* evident; but those who have worked closest and longest at details, in the open field of nature, know that it is true. Naturalists may quarrel and blunder about the relative importance of minute differences, and therefore about the limits of their "species"—and perhaps nearly all of them have erred in drawing too tightly the boundaries between which "varieties" are supposed to occur; but nevertheless the plain fact remains, that, on a broad scale, more or less abrupt and well-defined forms alone have as yet been discovered, and that they do *not* shade off into each other by that legion of osculant infinitesimal links on which the very life, as it were, of this ingenious theory mainly depends.

As to the evidence to be gathered from the endless phases which have been gradually matured in our domestic cattle and pigeons by the long and systematic efforts of man, we deny that any parallel can be drawn from them, on a general scale, in the feral world; for everything tends to prove that the whole system of certain species (though *not*, as it is admitted, of all), when under domestication, tends to become plastic; whilst, moreover, we cannot ascribe to the operation of a doubtful, unproved (and perhaps altogether imaginary) natural "law" effects in any way analogous to those produced by an active, living agent (and therefore an intelligent efficient cause) who has been capable for centuries of concentrating his efforts with judgment, caution, discernment, and skill, and of carefully selecting, by a direct action of *mind*, all the various divergences that were favourable for his purpose, and so of "adding them up" (as Mr. Darwin happily expresses it), one by one, in a given direction, beforehand decided on, until he has at last succeeded (though at times, even then, with the greatest difficulty) in accomplishing the purpose which he had in view. And, besides all this, it is admitted that there are, after all, *some* forms which he cannot succeed in modifying: which certainly would tend to prove that *even his* most persevering efforts can only avail with certain more or less *naturally elastic* organisms. And that some undoubtedly *are* "naturally elastic," as compared with

others, every naturalist who has worked six months under the open skies (instead of in his closet) is absolutely certain. Indeed, whilst we see hosts of species scarcely alter at all, in whatever circumstances and regions they are placed, and therefore whilst exposed to *innumerable conditions of surrounding organic forms*—so that (in a broad sense) they may be regarded as almost independent of the various influences alongside them,—we see, on the contrary, that other species are by constitution so unstable and shifting, in their external details, as scarcely to present *two phases alike* in even the several localities and altitudes of a continuous, unbroken tract. Nor is this mere assertion, for we are prepared to support it by the plainest facts; whilst, at the same time, we could point to a country in which nearly *all* the land-shells now existing (upwards of one hundred species) are found in a fossil state, conglomerated together in beds of indurated mud often twenty feet in thickness, and which have not altered, apparently, *so much as a puncture or a granule* during the enormous period (even though it be geologically recent) which has elapsed since they were first deposited,—a period, moreover, in which there is every reason to believe that the various physical conditions (and perhaps extent) of the whole region have most materially changed: which, at any rate, does not tally with that steady movement towards perfection, that certain progress, of some kind or other (even though slow), of organic forms, which a reception of this "natural selection" idea so loudly and positively demands.

As to the theological difficulties of this question, we must decline entering into them; for we believe that science and theology are best discussed apart, and that neither of them was ever intended to teach us the other. Nevertheless we fear it must be admitted that they are exceedingly grave, if not absolutely insurmountable; and, although as yet they have been altogether, and studiously, kept out of view, the time will assuredly come when, like all other objections, they must be fairly stated, the arguments on both sides candidly examined by competent judges, and each of them impartially weighed, on its own merits. Although it is obviously desirable, for more reasons than one, not to bring revelation and science into unnecessary contact (for the evils which have resulted from injudicious attempts to do so have usually been but too evident), still no man who loves truth, in all its phases, for its own sake, will long rest contented in accepting *as such* a zoological creed which is in direct antagonism with his theological one; for, since two opposite sets of statements cannot be both true, one or the other of them must eventually fall. The question simply is: which, in this case, shall it be? Although we might hazard a hasty reply, we nevertheless will not do so; though we can anticipate the feelings of our more learned theologians, were a bouquet of some of the leading conclusions culled for their special contemplation. What, for instance, would they think, when told that, in spite of their honest convictions (convictions which they had supposed to be coeval with our race), it has been lately discovered that man, with all his lofty endowments and future hopes, was, in point

of fact, never "created" at all, but was merely, in the fulness of time, a development from an ape; and not merely from an ape, but that he was originally derived from the same source as bears, cats, rats, mice, geese, mussels, periwinkles, beetles, worms, and sponges (nay, even, perhaps, from the same as the very plants themselves); that, in all probability, he will at length beget some higher creature still, and will himself "become utterly extinct," like each of the beasts (throughout time and space) before him; and that, moreover, "as all the living forms of life are the lineal descendants of those which lived long before the Silurian epoch,"—"*hence* [—a cold shuddering comes over us at what we are compelled to regard as a glorious *non sequitur*, and that, too, from premises which we cannot admit!]—*hence* (we repeat) we may look with some confidence to a secure future of equally inappreciable length!" Hard doctrine, this, for "unphilosophical" minds like ours! And, were we inclined to be sceptical as to the *data* on which this sweeping conclusion is built, we might naturally ask, how is it, *if the above premises be true* (*i. e.* if it indeed be a fact that man has been gradually qualified, by self-improvement, for his advanced post, after passing through an endless array of lower forms),—how is it that *no traditions whatsoever* bearing on the previous and more simple conditions of the human structure (immediately before it attained its climax of perfection) have ever been extant; for it is quite inconceivable that so radical an organic change could have been slowly brought about without, at the least, *some vague tradition of it* having become *a fact of the human mind.* When probed by such-like inquiries, the entire theory (*to the extent that it is pushed*) fairly crumples up.

But we must conclude this notice. Did space permit, we might have offered many remarks on the general tendencies of the Selection theory, *when carried out to its full extent.* We might have dived below the surface, to ascertain the main object of Mr. Darwin's clever and ingenious volume; and have asked, what it was that first prompted him to undertake it. If it was the marvel of creation (and a real marvel it assuredly is) that offered the primary stumbling-block to a philosophical mind, we might have asked whether the marvel would have been got rid of had we been able to reduce the number of the separate, independent acts. To our mind, the wonder consists in the act *at all*, and not in the number of times that it may have been repeated: for a Being that *can create* may surely do so as often as He pleases; and we have no right therefore to limit that act,—at any rate on the question of its *probability*; for, if we admit that it has been exerted so much as once, there is no *à priori* reason why it should not have been a million times repeated, or why, if He had so willed it, it might not, at some period or other, have been in even constant operation. Such an idea is difficult to conceive, we admit; but (be it remembered) *it is not one atom more so* than the process of creation *at all*: and with respect to the *marvel* of it (so difficult, and impossible, to understand), it may be well to recollect that it has been contended by some of our greatest minds that even the *sustaining* power of Nature is, in point of fact, as much of a miracle as the creative power.

Although we have felt compelled to say thus much against the theory so ably pleaded for in Mr. Darwin's book, we repeat that, *in a very limited sense indeed,* there seems no reason why the theory may not be a sound one; but at present, even to that extent, it remains to be substantiated. The volume is eloquently written, and its immense array of facts most carefully collected. But we are bound to add, that many an equivocal idea is shrouded under the fairest garb; and we find that we have sometimes swallowed a dose unconsciously, on account of the pleasant medium through which it was administered. And, as an instance of this, we will quote the concluding sentence of the whole work, which is certainly very beautiful, though we can scarcely believe that our author was in earnest when he wrote it. Here it is, without comment (the italics are our own):

"It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us: these laws, taken in the largest sense, being Growth with Reproduction; inheritance, which is almost implied by reproduction; variability from the indirect and direct action of the external conditions of life, and from use and disuse; a ratio of increase so high as to lead to a struggle for life, and as a consequence to Natural Selection, entailing divergence of character and the extinction of less-improved forms. Thus, from the war of nature, from famine and death, *the most exalted object which we are capable of conceiving, namely, the production of the higher animals,* directly follows. There is a grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed laws of gravity, from so simple a beginning, endless forms most beautiful and most wonderful have been and are being evolved."

Would not one step more plunge us headlong into the Nebular Hypothesis, and the whole theory of Spontaneous Generation?

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

March 22, 1859.—Dr. Gray, F.R.S., V.P., in the Chair.

Mr. Gould exhibited and characterized two new species of birds, one belonging to the family *Cuculidæ,* the other to the *Coturniceæ,* and remarkable as forming probably the smallest species of the groups to which they respectively pertained.

For a small Shining Cuckoo, killed at Port Essington, on the north coast of Australia, and of the same form and very nearly allied to the *Chrysococcyx lucidus* of New South Wales and the *C. basalis* of Java, Mr. Gould proposed the name of *Chrysococcyx minutillus*;

and for the Quail, which belonged to the genus *Excalfactoria* of Bonaparte, that of *Excalfactoria minima.*

The following are the descriptions of these new species :—

Chrysococcyx minutillus, Gould.

Head, all the upper surface, and wings shining bronzy-green; all the under surface white, barred with bronzy-green, the bars being most distinct on the flanks; primaries and secondaries white on the basal portion of their inner webs; two centre tail feathers bronzy-green; the next on each side bronzy-green on the outer web, rufous on the inner web, crossed by a broad band of black near the tip, and with an oval spot of white across the tip of the inner web; the two next on each side bronzy-green on their outer webs, their inner webs rufous, with large spots of black near the shaft, most conspicuous in the outermost of the two feathers; their inner webs are also crossed near the tip with a very broad band of black, and have an oval spot of white at the tip; the outer feather on each side is barred alternately on the outer web with dull bronzy-green and dull white, and on the inner one with broad decided bars of black and white, and tipped with white; bill black; feet olive.

Total length $5\frac{1}{2}$ inches, bill $\frac{5}{8}$, wing $3\frac{1}{4}$, tail $2\frac{1}{2}$, tarsi $\frac{1}{2}$.

Remark.—This bird is perhaps more nearly allied to the Javanese species, *C. basalis* of Horsfield, than to the *C. lucidus*; but it is as much smaller than the *C. basalis* as that bird is less than *C. lucidus.* The type of *C. basalis,* which is the only one I have seen, is not a fully adult bird; and yet the measurement of its wing exceeds by half an inch that of the *C. minutillus.*

Excalfactoria minima, Gould.

Forehead and sides of the head grey; crown of the head, all the upper surface, and wing-coverts reddish-brown, conspicuously spotted and minutely freckled with brownish-black, a line of buff down the crown and nape, and a narrow line of brownish-white down the centre of the feathers, changing to broad and conspicuous stripes of buff on the lower part of the back and tail-coverts; wings pale brown; chin and throat black, on each side of which is an oblong patch of white encircled by a narrow line of black; below the black a broad crescent of white, fringed on the sides with black, and bounded below by a narrow semicrescent of deep black; under surface grey, mottled on the flanks like the upper surface; line down the centre of the abdomen, thighs, and under tail-coverts chestnut-red; bill black; feet yellowish.

Total length 3 inches, bill $\frac{1}{4}$, wing $2\frac{1}{2}$, tarsi $\frac{5}{8}$.

Hab. Vicinity of Macassar, Celebes.

Remark.—For this, the most diminutive species of the *Gallinaceæ* yet discovered, we are indebted to the researches of A. R. Wallace, Esq. It is of precisely the same form and very nearly allied to, but quite distinct from, the well-known Chinese Quail, *Excalfactoria chinensis* (*Coturnix chinensis* of authors).

The following extract from a Letter received by Mr. S. Stevens

from Mr. Wallace, dated Batchian, Moluccas, Oct. 29, 1858, was read :—

"Here I have been as yet only five days ; but from the nature of the country, and what I have already done, I am inclined to think it may prove one of the best localities I have yet visited. Birds are as yet very scarce ; but I still hope to get a fine collection, though I believe I have already the *finest and most wonderful* bird in the island. I had a good mind to keep it a secret, but I cannot resist telling you. I have a new *Bird of Paradise*! of a new genus!! quite unlike anything yet known, very curious and very handsome!!! When I can get a couple of pairs, I will send them overland, to see what a new Bird of Paradise will really fetch. Had I seen the bird in Ternate, I should never have believed it came from *here*, so far out of the hitherto supposed region of the *Paradiseidæ*. I consider it the *greatest* discovery I have yet made ; and it gives me hopes of getting other species in Gilolo and Ceram. There is also here a species of Monkey—much further eastwards than in any other island ; so you see this is a most curious locality, combining forms of the East and West of the Archipelago, yet with species peculiar to itself. It also differs from all the other Moluccas in its geological formation, containing iron, coal, copper, and gold, with a glorious forest vegetation and fine large mountain streams : it is a continent in miniature. The Dutch are working the coals ; and there is a good road to the mines, which gives one easy access to the interior forests.

"I can do nothing at drawing birds, but send you a horrible sketch of my discovery, that you may not die of curiosity. I am told the wet season here is terrible, and it begins in December ; so I shall probably have to leave then."

The sketch alluded to in the above extract having been placed in Mr. G. R. Gray's hands for examination and comparison with the other known species, the following notes of that gentleman, relative to it, were read to the meeting :—

"This Paradise-Bird proves, as Mr. Wallace remarks in his letter, to be a new form, differing from all its congeners, approaching most nearly to the King Bird of Paradise ; but in place of the lengthened caudal appendages, it has, springing from the lesser coverts of each wing, two long shafts, both of which are webbed on each side at the apex. It is the possession of these peculiar winged standards that induces me to propose for it the subgeneric appellation of *Semioptera*.

"I have endeavoured to transform the rough sketch into the probable appearance of the living bird ; and I further add the provisional specific name of *Paradisea Wallacii*, which appellation I think is justly due to Mr. Wallace for the indefatigable energy he has hitherto shown in the advancement of ornithological and entomological knowledge, by visiting localities rarely if ever travelled by naturalists.

"I wait for the arrival of the specimens before venturing to give more detailed accounts of its subgeneric characters, or a full description of its coloration, &c., which I hope to have the pleasure of laying before the members at some future meeting of the Society."

Mr. G. R. Gray laid before the meeting a drawing of *Tringa pectoralis,* which was made by the late Mr. Adams, Surgeon of H.M.S. 'Enterprise.' It exhibited the bird in the act of having inflated its throat and breast in the manner of the Pouter Pigeon. From the correctness of the other drawings by the same gentleman, Mr. Gray had little doubt that Mr. Adams observed this singular phenomenon in the specimen from which the drawing was taken. The drawing was more especially placed before the members, in the hopes of learning whether such a singularity of habits had been noticed before in this species or in any other of the *Tringæ.*

The bird has peculiar feathers on its breast.

April 12, 1859,—Professor Busk, F.R.S., in the Chair.

Description of a New Species of Owl of the genus Ciccaba. By Philip Lutley Sclater.

Mr. Gurney has invited my attention to the example of an Owl of the genus *Ciccaba,* which I now exhibit. It has already passed through my hands once, having been submitted to my examination by M. Verreaux, along with other birds from Southern Mexico, of which I gave some account in these 'Proceedings' for last year. As will be seen by referring to my remarks given on that occasion*, I then somewhat unwillingly referred it to *Ciccaba huhula.* Mr. Gurney, however, having acquired the specimen for the Norwich Museum, agrees with M. Jules Verreaux (whose opinion to that effect I have already recorded) in insisting on its distinctness; and having lately had an opportunity of examining a second specimen of this bird in the collection of the Jardin des Plantes at Paris, I am now quite prepared to coincide with their views, and to characterize this Mexican *Ciccaba* as an independent species, differing from, though closely allied to, the S. American *Ciccaba huhula.* It may be recognized at once by the more uniform colour above, there being hardly a trace of white transverse markings, except on the elongated feathers of the neck-collar; and by the ground-colour below being pure white, crossed by frequent narrow bands of black, each feather showing three or four of such cross-bands. I propose to call this bird

Ciccaba nigrolineata.

Schistacescenti-nigra, colli postici plumis elongatis et albo ter quaterve transfasciatis : maculis in regione superciliari et auriculari quibusdam albis : subtus alba, lineis nigris crebro transfasciata : mento nigro : subalaribus albis, nigro variegatis : cauda nigra, albo quinquies transfasciata : rostro et pedibus flavissimis : tibiis nigris, albo sparsis.

Long. tota 15·0, alæ 10·5, caudæ 6·78, rostri a rictu 1·35, tarsi 2·1.

Hab. In Mexico Meridionali. *Mus.* Norfolciense et Parisiense.

Note on the Spur-winged Geese (Plectropterus) now living in the Society's Gardens. By Philip Lutley Sclater.

The Society have frequently possessed living examples of the Spur-

* See P.Z.S. 1858, p. 96.

winged Goose of Western Africa (*Plectropterus gambensis*); and we have at present two male examples of this bird in the Gardens. Last summer, along with the Secretary-birds (*Serpentarius reptilivorus*), came two Spur-winged Geese from Eastern Africa. They were placed in the Gardens along with the W. African pair, and immediately attracted the notice of those who take an interest in such matters, as being apparently of a different species. Comparing the males of the eastern and western birds together, we observe that the former is larger, stands considerably higher, and has longer tarsi and larger feet. There is a large oblong naked space of bare pink skin on the throat, which is wholly wanting in the West African bird; the beak is longer, and the bony protuberance on the front is much larger and more elevated. We have not, unfortunately, the female of the eastern species; but Rüppell tells us that in her too there is a stripe of naked skin between the eye and the base of the bill. Now in the western bird the whole sides of the head in both sexes are closely feathered: the male has a frontal protuberance (much smaller, however, than in the eastern species); the female has none. It appears therefore that two species have been confounded together under the name *gambensis*. The West African bird, originally brought from the Gambia (whence the name), and which has been described and figured as such by Latham, Yarrell, and other writers, is obviously the proper owner of the title *Plectropterus gambensis*; while the East African bird, first accurately figured and described by Dr. E. Rüppell in the third volume of the 'Museum Senckenbergianum,' may very appropriately take the name of *Plectropterus Rüppellii*.

On examining the stuffed specimens in the gallery of the British Museum, as I have been enabled to do through Mr. G. R. Gray's kindness, I find examples of both species. Of the larger *Plectropterus Rüppellii* there is a male bird procured during Clapperton's expedition in Central Africa, and a female which died in the Zoological Gardens. Of the smaller *Plectropterus gambensis* there is one from Western Africa, and one of which the locality is not marked. An immature bird from the Cape is certainly referable to the smaller species.

The separation of these two birds may not perhaps be entirely satisfactory until we have had an opportunity of examining their internal structure, several parts of which, particularly the trachea, are well known to afford good characters for discriminating nearly allied species among the *Anatidæ*, as has been so successfully shown in Mr. Eyton's Monograph.

Notes on the Scaly Ant-eater (Manis javanica), taken during life and after death. By Arthur Adams, F.L.S., Surgeon H.M.S. 'Actæon.'

A. *During Life.*

Two living specimens of this singular mammal having come under my observation, I am induced to offer some account of their habits as far as I was enabled to make them out.

Our first Ant-eater is a female, and rejoices in the *sobriquet* of "Scales." She is crepuscular, and remains coiled up in a ball during the day, secure in her scaly panoply; but at the decline of day she grows lively. Now a creature whose habits require to be studied by the aid of a dark lantern must needs be interesting even to the most incurious; and a Lizard-like Mammal whose every movement and attitude is probably a living illustration of those great extinct quadrupeds which once peopled the earth before man was created, must certainly have the power of arresting the attention, if not of stimulating the imagination. I doubt not Professor Owen would have lain prone on his stomach all the livelong night to watch the evolutions of this gnome-like mountaineer. And indeed there is something old-world and weird in her aspect as she prowls about at night. The Scotch would say she has an "uncanny" look; and truly, if but ten times bigger, she would unmistakeably remind one of the times before the Deluge. When she walks she treads gingerly on the bent-under claws of her fore feet, and more firmly on the palms of her hind feet. A very favourite attitude with her is that assumed by her gigantic extinct analogue the *Mylodon*, as seen in the wondrous model of Waterhouse Hawkins in the Gardens of the Crystal Palace. The fore feet in my "Madam Scales" are raised; and the animal is supported by the strong hind limbs, and firm, flattened, powerful muscular tail, the head and body being at the same time moved from side to side, and the little round prominent eyes peering curiously about in every direction. In walking, the fourth toe of the hind foot is also extended. The Chinese, in their sly manner, say that she pretends to be very quiet; but "s'pose no man lookee," she runs very fast. She is certainly of a very timid and retiring disposition, tucking in her head between her fore legs on the least alarm. So apathetic a quadruped appeared our "Pangolin" (for such is she called by the Malays), that, coiled up in a strong net, I considered her properly secured, and carefully deposited her in my cabin. But no sooner did the last gleam of light vanish from my little "scuttle" than she knew the period of her lethargy had expired, and, bursting the trammels of her hempen toil, she roamed abroad; and the first intimation I had of her escape was the ominous bark of Master "Wouff," a clever little terrier we had on board. Dog, puzzled by the queer scaly rat he had suddenly encountered, regarded with impotent rage the lizard-like intruder; while "Scales," secure in her coat of mail, bid defiance to the attacks of her canine assailant.

The Scaly Ant-eater is called by the Chinese of Quang-tung "Chun-shau-cāp," which literally means "Scaly Hill-borer." They also name it "Ling-li" or "Hill-Carp;" and it seems to be regarded by them as truly "a fish out of water." They say it lives in the sides of the great mountains, and that it lays a trap for insects by erecting its scales, when, suddenly closing them, flies, ants, and other intruders are secured, and, when dead, fall out and are eaten. They also assert that it feeds upon fish; but both these stories appear to be myths something similar to those told of our own familiar "Hedge-pig" sucking the teats of cows, and impaling apples on her

quills in the orchards. The *Manis javanica* is sold in the markets at Canton, and is often carried about the streets as a curiosity. The scales are employed by the Chinese for medicinal purposes; but the flesh does not appear to be eaten, though it is very excellent food when roasted, as I can testify from personal experience, having had a portion of the defunct "Scales" nicely cooked. The *Manis* climbs very well, and can suspend itself head downwards by means of its strong flat tail. We fed our "Scaly Hill-borers" on raw eggs and chopped raw beef, on which they seemed to thrive. The unfortunate "Scales" fell a victim to female curiosity. Exploring the hold of the ship in one of her midnight rambles, she was lost for a time, and at length found her way back to her box, where she died of starvation.

B. *After Death.*

Our specimen was an adult female, weighing 4 lbs. The length from the end of the nose to the root of the tail was $14\frac{1}{2}$ inches, of the head 3 inches, and of tail $10\frac{3}{4}$; extreme length 2 feet $1\frac{1}{4}$ inch.

Head.—The eye is protuberant, and the cornea remarkably convex; the vision is lateral; the eyelids are pyriform, the pointed end forward, the upper lid well-rounded; the iris is brown, with a tinge of green. The nostrils and lips are fleshy, naked, and, when the animal is alive, constantly moistened by a mucous secretion. The ears are naked and open. The tongue (used as a feeler during life) is 9 inches in length, and is enclosed in a membranous sheath; it is highly retractile and muscular, subcylindrical at the base, flattened at the anterior half, grooved on the upper surface, and beset with prominent papillæ. At the hinder end of the groove, arranged in the form of an equilateral triangle, are three pores which secrete a viscid fluid. The epiglottis is broad and hood-like; the thyroid glands are $2\frac{1}{2}$ inches in length and $1\frac{1}{4}$ in width: they are very large, ovate, and pointed at each end.

Thorax.—The mammary glands are large, pectoral, two in number, and well developed. The lungs are composed of three lobes on the right, and two on the left side; the middle lobe very small; the lower lobe furnished with a process which embraces the base of the heart. The heart is central, large, and oval; the auricles very distinct; the ventricles thick and fleshy; the columnæ carneæ and chorda tendinea very strong; the vena cava very large. The liver is large and five-lobed; the upper lobe is large, the middle is notched in front, irregular and trilobate; the left lateral is rounded, with a thin edge; the right lateral is subcylindrical and truncate below. The gall-bladder is large, and placed between the upper central and right lateral lobes of the liver. The pancreas is of loose texture, transversely elongated, flattened and pointed, obliquely truncate at one end, angular and pointed at the other; coiled up, imbedded in a sac on the outer surface of the truncate extremity, was a small slender worm.

The omentum is thin and membranous, with no fat; the mesentery is membranous and transparent, the vessels conspicuous, and the glands large, brown, and flattened.

The stomach is simple, 4 inches in length, the greatest breadth 3 inches; coats muscular, especially at the pyloric extremity, where the muscle is thickened so as almost to form a fleshy gizzard. The mucous membrane is loosely corrugated at the cardiac end, and densely covered with papillæ at the pyloric extremity. There is a central pyriform tubercle suspended from the lesser curvature, projecting into the cavity of the stomach.

Between the thickened parts of the stomach, imbedded in the coats on the greater curvature, and midway between the cardia and pylorus, is a small sac surrounded by a mass of glands, the use and structure of which are to me unknown.

The small intestines are 10 feet 10 inches long, and half an inch in circumference; they are dark-coloured and vascular.

The cæcum is $2\frac{1}{2}$ inches in length and 1 inch in circumference. The large intestines are 10 inches long and $1\frac{1}{2}$ inch in circumference.

The kidneys are ovoid, large, and smooth; the pelvis ending in a single follicle or sac; the ureters end near the neck of the small pear-shaped bladder.

The ovaries are $\frac{1}{4}$ inch long, small, yellow, ovoid, and spotted, and situated at the inner side of the horns of the uterus.

The uterus is divided above into two horns, which are curved inwards and downwards; each cornu is 1 inch in length; body of uterus $1\frac{1}{2}$ inch long and subcylindrical. Fallopian tubes 2 inches in length. Vagina long and muscular. Anus immediately behind vulva at root of tail; there is a transverse linear opening leading to a *cul de sac* $\frac{1}{2}$ inch deep, studded with conical papillæ, and which is the seat of the peculiar alliaceous odour of the *Manis*.

A second Entozoon was found in the muscles of the lumbar region.

MISCELLANEOUS.

On the Nidification of the Kingfisher (Alcedo ispida). By John Gould, V.P., F.R.S., &c.

Ornithologists are divided in opinion as to whether the fish-bones found in the cavity in which the Kingfisher deposits its eggs are to be considered in the light of a nest, or as merely the castings from the bird during the period of incubation. Some are disposed to consider these bones as entirely the castings and fæces of the young brood of the year before they quit the nest, and that, the same hole being frequented for a succession of years, a great mass is at length formed; while others believe that they are deposited by the parents as a platform for the eggs, constituting in fact a nest,—in which latter view I fully concur; and the following are my reasons for so doing.

On the 18th of the past month of April, during one of my fishing excursions on the Thames, I saw a hole in a precipitous bank, which I felt assured was a nesting-place of the Kingfisher; and on passing a spare top of my fly-rod to the extremity of the hole, a distance of

nearly three feet, I brought out some freshly-cast bones of fish, convincing me that I was right in my surmise. The day following, the 9th of May, I again visited the spot with a spade, and, after removing nearly 2 feet square of the turf, dug down to the nest without disturbing the entrance-hole or the passage which led to it. Here I found four eggs placed on the usual layer of fish-bones; all of these I removed with care, and then filled up the hole, beating the earth down as hard as the bank itself, and replacing the sod on the top in order that barge-horses passing to and fro might not put a foot in the hole. A fortnight afterwards the bird was seen to leave the hole again, and my suspicion was awakened that she had taken to her old breeding-quarters a second time. The first opportunity I had of again visiting this place, which was exactly twenty-one days from the date of my former exploration and taking the eggs, I again passed the top of my fly-rod up the hole, and found not only that the hole was of the former length, but that the female was within. I then took a large mass of cotton wool from my collecting-box, and stuffed it to the extremity of the hole, in order to preserve the eggs and nest from damage during my again laying it open from above. On removing the sod and digging down as before, I came upon the cotton wool, and beneath it a well-formed nest of fish-bones, the size of a small saucer, the walls of which were fully half an inch thick, together with eight beautiful eggs and the old female herself. This mass of bones, then, weighing 700 grains, had been cast up and deposited by the bird or the bird and its mate, besides the unusual number of eight eggs, in the short space of twenty-one days. To gain anything like an approximate idea of the number of fish that had been taken to form this mass, the skeleton of a minnow, their usual food, must be carefully made and weighed; and this I may probably do upon some future occasion. I think we may now conclude, from what I have adduced, that the bird purposely deposits these bones as a nest; and nothing can be better adapted, as a platform, to defend the eggs from the damp earth.—*Proc. Zool. Soc.* May 10, 1859.

Descriptions of new Species of Salamanders from China and Siam. By Dr. J. E. Gray, F.R.S., V.P.Z.S., &c.

Mr. Fortune, on his late return from China, brought with him for the British Museum a bottle containing a Salamander, some Fishes, and a Leech, collected from a river on the north-east coast of China, inland from Ningpo.

The Fishes are two varieties (olive and golden) of a very peculiar monstrosity of the common gold fish of China, *Cyprinus auratus*, which has long been known, and is figured in several of the Chinese works.

It is peculiar for having a very short and thick body, entirely destitute of any dorsal fin, with a regularly trifid or three-finned tail, and more especially for having very large and swollen eyes, which give a distorted appearance to the animal,—the pupil of the eyes

being on the upper part of the swollen orbs, and on a level with the upper surface of the back.

The Salamander or Newt was obtained from the same stream. It is curious as being the first example of the family which has been found in Continental Asia, though there are several species common in Japan.

It is nearly allied to, and appears to belong to the same genus as one of the Japanese specimens; but at the same time it is quite distinct, as a species, from any yet received from that country.

It may be indicated as—

CYNOPS CHINENSIS.

Above uniform dark olive (in spirits); beneath bluish-black, with small, unequal, irregular, yellow spots on the chin, neck, belly, and under side of the legs; the spots on the belly are the largest; the under edge of the tail reddish-yellow; skin acutely granular.

Var. 1. Tail pale grey, brown on each side, with a blackish marginal band above and below, and with a yellow inferior edge.

Hab. River, N.E. Coast of China, inland from Ningpo.

This species resembles in the form of the head, the parotid glands, and in the granular state of the skin, *Cynops pyrrhogaster* of Japan; but it differs from it in its much larger size and in the style of its colouring, especially on its under side. *C. pyrrhogaster* is dark red, with large black blotches or spots; while this is dark lead-coloured, with small yellow spots.

The Leech is one of the Land Leeches, with a lunate head, similar to those received from Ceylon.

The British Museum has also received, in a collection of reptiles and fishes obtained in Siam by Mr. Mouhot, two specimens of a species of Newt, which is so exceedingly like the *Plethodon glutinosum* of North America in external appearance, that is to say in form, size, and colour, and also in the distribution of the palatine teeth, that I was at first inclined to regard them as specimens of the American animal which had been sent to Siam. But I cannot believe this to be the case, as they were enclosed in a bottle containing several kinds of reptiles, which are evidently all natives of Siam. I may observe that this is the first time that any species of Newt has been received from Continental India.

I propose to designate the Siamese species

PLETHODON PERSIMILE.

Black, white-speckled, the specks closer and more abundant on the sides; the hind toes elongate, unequal. Tail compressed.

Hab. Siam.

The only character that I can find between the two specimens received from Siam, and some twenty or more of *P. glutinosum* from different parts of the United States in the Museum collection, is that the toes of the hind feet appeared rather longer, more slender, and unequal in length, and the tail much more compressed.—*Proc. Zool. Soc.* June 28, 1859.

THE ANNALS

AND

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[THIRD SERIES.]

No. 27. MARCH 1860.

XV.—*On new Fossil Crustacea from the Silurian Rocks.* By J. W. Salter, F.G.S., A.L.S.

The Phyllopod group, rather poorly represented in modern seas, was rich in species and genera in palæozoic times, if we are correct in referring to it the numerous bivalved and *Apus*-like forms in mountain limestone and the Silurian strata. The species were of large size, too, compared with living members of the group—the bivalved forms generally larger than *Estheria*, and (if, as is most probable, the great *Posidoniæ* from the Carboniferous rocks be truly Crustacean) far larger even than *Limnadia*. Numerous smaller species accompany these, of a great variety of forms; and these are only now beginning to be made known by Mr. Rupert Jones and M. Barrande.

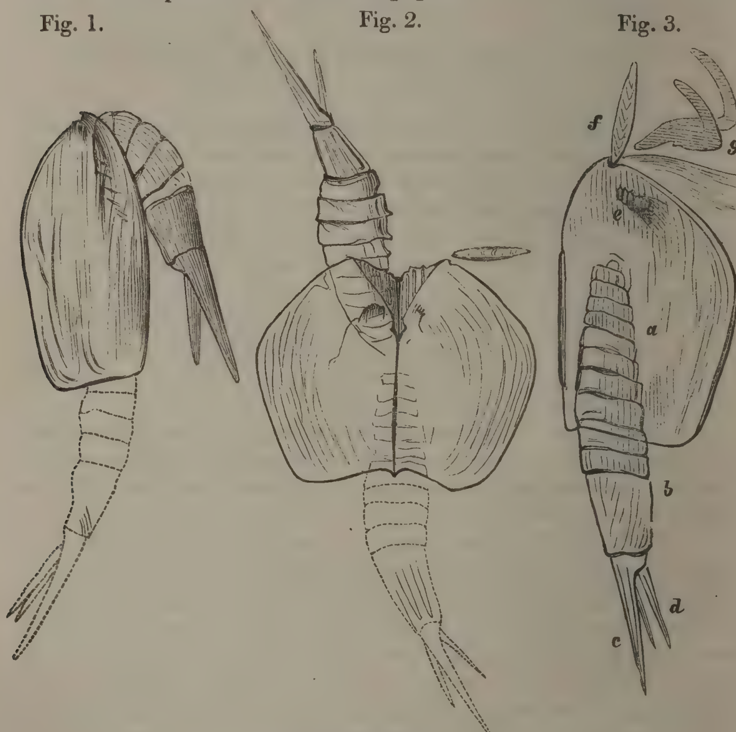
Of the forms like *Apus* less is known; but the *Dithyrocaris* of the Scotch coal-shales is pretty generally allowed to be a great Phyllopod, with a carapace not more bent than that of *Apus*, if so much so.

Ceratiocaris, a Silurian fossil, of equal size, was first described by Professor M'Coy in the 'Annals Nat. Hist.' vol. iv. p. 412; and some details were filled up by myself in the 'Quarterly Geol. Journal' for 1856, vol. xii. p. 33. At the time that Prof. M'Coy wrote, only half carapaces were known, and the relations of the animal could not be very clearly made out; but the mucronate anterior and truncate posterior margin, and the fine longitudinal sculpture were figured by him, as well as an anterior tubercle, which he regarded as an eye-spot, but which proves to be the impression of the hard mandibles pressed through the crust. Good specimens were afterwards found in the south of Scotland, at Lesmahago, Lanark, a spot now famous for its rich fossil beds; and these showed the body-rings, telson, and lateral appendages. The appendages had been long known, in a disjointed form, as *Leptocheles*, M'Coy. A restored diagram of the animal was given

by me in the communication above referred to, which is correct so far as it goes, but now requires additions.

In the second edition of 'Siluria,' 1859, a supposed correction was published by me with respect to the position of the carapace. No specimens had till then been found that had the body-rings actually in connexion with it; but the occurrence of a third specimen (fig. 3.) with all the parts *in situ*, has shown more clearly that the position of the abdomen given in 'Siluria' was not the true one, but that it had been (singularly enough, in both cases) forced forwards, so as to protrude from the anterior end! Figure 3 only has the parts in right position, and all three figures belong to the same species—*Ceratiocaris papilio*.

Fig. 1. Fig. 2. Fig. 3.



Ceratiocaris papilio, *Salter**.

The three figures show the animal in various postures in the stone:—

Fig. 1. The valves closed, but with the abdomen bent round and protruding from the front of the carapace.

Fig. 2. A specimen similarly distorted, with the valves open. The dotted lines show the proper position in both figures.

Fig. 3. shows all the parts *in situ*, with the jaws, *e*; rostrum, *f*; antennæ (or thoracic appendages?), *g*; *a*, *b*, thorax and abdomen; *c*, telson; *d*, caudal appendages.

* See 'Siluria,' 2nd ed. p. 262, f. 1, 2.

A further exploration in the same rich deposits at Lesmahago, where *Ceratiocaris* occurs in millions (and in these beds no other fossil has yet been brought to light), has disinterred the rostrum *, hard jaws, and also the antennæ or some of the thoracic appendages of the animal. The last are obscure, but were detected by Prof. Huxley, who also found a clearly articulated hinge uniting the two flaps of the carapace. This is a very important character, and will remove *Ceratiocaris* from any very near alliance with *Nebalia*, from which also the solid jaws, like those of *Apus*, and the greatly developed telson, often three times the length of the other caudal appendages, tend further to separate it. In *Nebalia* the telson is reduced to 0, and the appendages are large.

The length of the largest *Ceratiocaris* yet known could not have been less than 15 inches. The characters of the genus may stand as follows:—

Ceratiocaris, M'Coy, 1851.

Carapace bivalved, united by an articulated hinge; the valves ovate, semiovate, or subquadrate, mucronate or uncinate in front, and more or less truncate behind. Rostrum broad, of a single lanceolate piece. (Head or thorax with obtuse (jointed?) appendages). Body many- (fourteen- or more) jointed, of which five or six segments extend beyond the carapace; the last one longest, and supporting a strong bulbous telson and two shorter appendages. Surface generally lineate, often finely so.

1. *C. papilio*, Salter.

('Siluria,' 2nd ed. 1859, p. 262. f. 1, 2.)

C. 3–4-uncialis, cephalothorace magno, abdomine breviore. Cephalothorax tenuissime striatus, oblongus, antice latior. Annuli corporis numerosi (13 et ultra?), 3–4 ultimi solum liberi, hi quam longi ter latiores, ultimus precedentem quater excedens. Appendices validæ, centralis (*telson*) longa paullum recurva, costata, laterales latæ.

This beautiful species occurs with the next, but is less common. The much shorter body—scarcely longer (tail included) than the great carapace—easily distinguishes it. We have specimens both with the valves open and closed; and it is this

* The part *f* (fig. 3), supposed to be analogous to the rostrum in *Nebalia* (see Gaimard, Voyage Scandinav. 1845, pl. 40. f. 2 *b*) is generally joined to the carapace of the fossil. It is very closely and beautifully striate, V-fashion, from end to end. It occupies the place where the antennæ might be expected to occur, but is only a single piece. My friend Dr. Kinahan of Dublin suggested that it might prove to be the rostrum; and I fully agree with him. The striation favours this view materially.

species which shows so strange a tendency to invert the position of the abdomen. (See figures 1, 2.)

Locality. Black flags (Upper and Lower Ludlow) at Lesmahago, Lanark. Found by Mr. R. Slimon of that town.

2. *C. stygius*, n. sp.

C. 8–9-uncialis, tenuissime striatus, oblongus, margine ventrali plus minusve angulato. Annuli numerosi, sex ultimi solum liberi, reliqui a cephalothorace tecti. Segmenta libera quam longa bis latiora, ultimum precedens plus dimidio longius. Appendices caudales validæ, centralis longa subrecta costata, laterales latæ.

This of all the species is the most common, and may literally be said to form mountains in Lanarkshire. Large tracts of moorland at and around Nutberry Hill and on the Logan Water and Nethan Water, S.W. of Lanark, are composed of blackish slate, with many stone bands amongst it; and of these shales nearly every slab has some fragment or other of a *Ceratiocaris*, and often they are perfect. Mr. Slimon of Lesmahago has collected them by hundreds, and supplied many museums with them*.

The much greater proportional length of the body-segments, which are not concealed beneath the carapace, will at a glance distinguish the present species from *C. papilio*, to which species its finely striated carapace and the nearly equal length of the appendages closely ally it. It is possible that these two forms may represent different sexes of the same species; but there are at least two varieties of carapace in *C. stygius* itself, one more square and obtuse than the other; and as there are also differences of proportion in the abdominal segments of these varieties, it will be more reasonable to refer such slight differences to sex, and allow the *C. papilio* to rank as a species.

Locality. Lesmahago Hills; Nutberry Hill, as above; in Upper and Lower Ludlow rock.

3. *C. inornatus*, M'Coy.

(Synopsis Foss. Woodw. Mus. pl. 1 E. fig. 4.)

C. modicus; cephalothorax biuncialis, quam latus bis longior, ovato-oblongus, convexus, margine ventrali valde arcuato. Mucro anticus rectus. Superficies lineis remotiusculis interruptis. Telson costatum.

On this species Prof. M'Coy founded the genus.

Its carapace has much the general shape of that of *C. stygius*, but appears to have been far more convex, and has a straight,

* I beg to call attention to Mr. Slimon's beautiful collections of the large and perfect Crustacea (*Pterygoti*, &c.) from these beds, and to recommend him to the notice of all collectors of Silurian fossils.

projecting, anterior mucro. The striation is coarse. We have not found the body-rings; but a fragment of the telson from Kendal shows a ribbed surface.

Locality. Benson Knot, Kendal, in Upper Ludlow rock.

C. ellipticus, M'Coy, *l. c.* pl. 1. fig. 8, appears to be only an incomplete specimen of *C. inornatus*, but probably of a distinct variety. It has all the angles rounded off, or, as I believe, partly concealed in the stone. It is from the same locality.

4. *C. Murchisoni*, M'Coy, sp.

Figured as a fish-defence (*Onchus Murchisoni*) in the 'Silurian System,' 1839, pl. 4. figs. 10, 64*, and described as part of *Pterygotus* (*Leptocheles*) *leptodactylus*, M'Coy, Synops. Woodw. Foss. p. 176. *Ceratiocaris Murchisoni*, 'Siluria,' 2nd ed. pl. 19. fig. 1, p. 263.

C. modicus. Cephalothorax biuncialis, oblongus, convexus, lineis remotis interruptis subrectis ornatus. Abdomen segmento ultimo perstriato. Appendices caudales longæ, subcylindricæ, centralis (*telson*) ad basin bulbosa costaque dorsali percurrente valida; laterales longæ; omnes costatæ.

Of this, the first-discovered species, only numerous fragments are known. Its telson was figured, as above noted, for a fish-defence; and it is indeed difficult, without the microscope, to decide whether some of the hollow spines found in the uppermost Silurian beds be those of Crustacea or Fish. This, however, is quite a clear case. It was determined to be Crustacean by Prof. M'Coy in a paper full of acute observation, published by him in the 'Quarterly Geol. Journal,' vol. ix. p. 12. He, however, thought it to be the long didactyle claw of one of the *Pterygoti*, which he considered closely related to *Limulus*.

Locality. Only in the Upper Ludlow rock and Downton Sandstone, near Ludlow; specimens are in the collections of the Ludlow geologists, and in the Museum of Practical Geology.

5. *C. leptodactylus*, M'Coy, sp.

Pterygotus (*Leptocheles*) *leptodactylus*, M'Coy, Syn. Woodw. Foss. pl. 1 E. figs. 7, 7 *a*, 7 *b* (not *c*, *d*).

C. pedalis et ultra, elongatus. Cephalothorax longus triangulatus, antice acutus, postice valde rotundatus, latus. Segmenta libera 7–8? subquadrata, lateribus profunde impressa. Appendices longæ striatæ, centralis (*telson*) lateralibus longis vix crassior. Superficies capitis lævis, nisi lineis brevissimis sparsis notata,—segmentorum perstriata.

This is of quite a distinct type from those before described,

* Fig. 63 may be a portion of another species: it is strongly keeled.

having the carapace broad behind and narrowed in front. It is the largest of all the British species, yet probably inferior in size to the great *Ceratiocaris* (*Leptocheles*) *bohemicus* of Barrande * or the *C. Dewii* (*Onchus*, Hall, Palæontology New York, vol. ii. pl. 71). It must have measured a foot when extended. One large and fine specimen, presented to the Museum of Practical Geology by Mr. Alfred Marston, has all the parts *in situ*, and, besides showing the toothed jaws, enables us to connect the numerous scattered relics of the species, and to restore to them the tail-spines figured by Prof. M'Coy. Strictly speaking, the name *leptodactylus* is inapplicable to tail-spines, though appropriate enough when these were regarded as the chelæ of a Limuloid Crustacean. But the advantage of a more accurate name cannot compensate for the introduction of a synonym; and Prof. M'Coy deserves our best thanks for his suggestive notes on this and the previous species. One of his figures, referred to *P. leptodactylus*, belongs to the next species.

6. *C. robustus*, n. sp.

Pterygotus (*Leptocheles*) *leptodactylus*, M'Coy, *l. c.* (in part), pl. 1 E. figs. 7 *c, d* only (one of the lateral appendages).

C. modicus. Telson 2½-unciale, crassum, costatum, nisi ad basin convexum (haud gibbosum) lævigatum. Costæ in dorso tres tuberculosæ, infra 4–5 læves. Appendices latæ, lanceolatæ, planæ, acutæ.

The rows of lateral tubercles found on the telson of several species are particularly conspicuous in this; but they are raised (not sunk) tubercles along the outer costæ in *C. robustus*; and neither they nor the central rib run up upon the convex base. The under side has several ribs. The lateral appendages are remarkably broad and flat, and reach about three-fourths the length of the central one. Some specimens (Lower Ludlow rock) have the points of the telson more attenuated. These may be males, or they may indicate a separate variety. The spines in this rather striking species are remarkably thick and broad.

Loc. Ludlow (in Upper Ludlow rock); in the cabinet of R. Lightbody, Esq. Leintwardine, in Lower Ludlow rock.

7. *C. decorus.*

Phillips, Mem. Geol. Survey, vol. ii. pt. 2. pl. 30. fig. 5.

Very little is known of the species represented by this fragment. It appears nearly smooth and few-ribbed.

Loc. Ludlow rock of Freshwater East, Pembrokeshire.

* Not yet published. M. Barrande has, however, sent several of his beautiful plates to England.

8. *C.? ensis*, n. sp.

Telson magnum, 6-unciale, compressum, ad basin bulbosum, ensiforme; apice incurvo, margine dorsali crenato-serrato, lateribus planis nisi utrinque costa valida subcentrali ornatis.

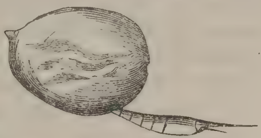
In all probability this is the telson of a remarkable species; for it has the bulbous base; but it is so compressed laterally as to be almost flat, and towards the end is curved down into a sabre-shape. The breadth is greatest near the base, the tip rather blunt. A lateral ridge, nearer the dorsal than the ventral edge, runs two-thirds along each side from the apex, but does not reach the bulbous base.

Locality. Leintwardine, Shropshire; Lower Ludlow rock.

9. *C. vesica*, n. sp.

C. parvulus, biuncialis, lævis, capite pyriformi, inflato, corpore tenuissimo abbreviato. Cephalothorax late ovatus, apice angusto, margine dorsali valde curvo. Segmenta corporis libera 5, quorum ultimum longe maximum. Appendices attenuatæ.

This curious bladder-like species may very likely become the type of a new genus, in which case *Physocaris* would seem appropriate. The posterior edge is not at all truncate, the dorsal margin is much curved, and the anterior end narrowed and with a small beak.



Cerat. (Physocaris) vesica.

10. *C. cassia*, n. sp.

C. sesquiuncialis, oblongus, striatus, corpore brevissimo. Cephalothorax oblongus, antice rotundior, postice truncatus falcatus, lineis subrectis remotiusculis. Segmentum ultimum (solum liberum) corporis angustum, appendicibus brevibus.

The oblong shape of this obscure fossil would not be quite sufficient to found a species on, though it distinguishes it from most others. The greatly abbreviated body, showing but one (?) joint beyond the carapace, and with very short appendages, is a better character.

Loc. Lower Ludlow rock, Leintwardine.

One other fossil must be noticed here, as it has figured prominently in the original description of the genus by M'Coy. The *C. solenoides* of that author (*l. c.* pl. 1 E. fig. 5) is really a species of *Solen* or an allied genus, as I at first supposed and classed it accordingly as *Solenomya*, *Cultellus*, or an allied genus. (See Prof. Sedgwick's Lists of Kendal Fossils: Wordsworth's 'Letters on the Lakes,' 1843–1846, Appendix.) I have nowhere given it

the specific name (as Prof. M'Coy supposed) of *Cultellus*? *rectus,* but I accept the term; and as the *subgenera* of *Solen* are not very likely to be found in Silurian rocks, it had better be called *Solen rectus.* It is perhaps quite as much like *Ceratiosolen.*

Prof. M'Coy has rejected it from this society, and figured it with the form and lineation of *Ceratiocaris,* with a thickened ventral margin and with an eye-spot. A careful examination of fresh specimens convinces me, however, that he has been mistaken in these characters.

Moreover, the general form is so like that of one of the *Solenidæ,* that it would seem to require something more than close criticism to refer it to anything else. The anterior side is rounded off, and the posterior truncate. There is even a slight fold along the dorsal margin—a character very common in bivalve shells; and lastly, there are a few concentric ridges of growth on the posterior side, while the disk only is occupied with close and numerous striæ parallel to the edge. These striæ have apparently misled Prof. M'Coy, who supposed that they covered the whole surface, as in *Ceratiocaris.* Moreover the internal oblique ridge extending backwards from the beak is no uncommon character of the *Solenidæ.* Prof. M'Coy supposed it to be the nuchal furrow.

Not having till now had access to good specimens, I for some time thought its new association with Crustacea correct; and I catalogued it as a *Ceratiocaris* in 'Siluria,' 2nd ed. Appendix, p. 538; it is, however, necessary to restore it to the Mollusca.

I believe there are other forms of the genus even in Britain, besides these nine or ten species which have all turned up in the course of a year or two. Abroad, still larger specimens have been found in Upper Silurian rocks. M. Barrande has figured the tail-spines of three species, of which his *Leptoc. bohemicus* has the greatest resemblance to our *C. Murchisoni*; and, as above noted, a large species, *C. Dewii,* has been figured as a fish-defence by Hall, from the Niagara limestone of New York. Our own Dudley limestone contains one species; but the metropolis of this curious Silurian 'shrimp' is in the Lower Ludlow rock, where it keeps company with *Pterygoti* and other large Crustacea. It appears not to have been a long-lived genus, for as yet none have been detected below the Wenlock limestone or above the Upper Ludlow rock. I should perhaps except a fragment of a large carapace sent me from the Llandeilo flags? of Dumfries by my friend Prof. Harkness. But the rock and the fossil both bear such a suspicious resemblance to the specimens of *C. stygius,* that I wait for better evidence before admitting the existence of the genus so far back in time. However, a much

smaller species occurs in the black anthracite shales of Dumfriesshire, which are generally believed to be of Lower Silurian age. It is the

11. *Ceratiocaris aptychoides.*

(*Dithyrocaris aptychoides,* Salter in Quart. Geol. Journ. vol. viii. pl. 21. fig. 10)—a minute species.

Locality. Duffkinnell, Dumfriesshire. Prof. Harkness.

This would appear to belong to the Llandeilo flags; but it is possible the age of the formation may be more accurately given by the fossil, and the black anthracite shales may not have the antiquity they at present claim.

On the whole, about fifteen species have been recorded of this interesting genus, which combines to some extent the characters of *Nebalia* and of *Limnadia.* It will doubtless form the type of a distinct family.

With *Ceratiocaris,* in the south of Scotland, is associated another and still larger form, which I will now describe.

Dictyocaris.

More plentiful in fragments than even the *Ceratiocaris,* in the shales and sandstones of the Lesmahago hills, is a great Crustacean, apparently of very thin texture, whose carapace frequently measures from 9 inches to a foot in length! This rivals in size the great *Pterygoti,* among which its remains are often found. The anterior termination of the carapace has not been seen; its posterior edge is truncate, as in *Ceratiocaris,* and with a strong marginal furrow; and its ventral border must have been so produced as to give it a subtriangular outline. Some fragments of body-rings found with it may indicate its relationship to *Ceratiocaris,* from which its simply bent (not bivalved) shield distinguishes it.

The entire surface of the carapace is marked with hexagonal reticulations $\frac{1}{30}$th of a line in diameter, of which the areæ are convex, and the bounding lines sunk on the exterior aspect. This would, I think, indicate the ornament to be connected with the structure of the carapace rather than to be a mere external sculpturing. As no films can be obtained thick enough to furnish a section for microscopic examination, the point cannot be ascertained.

There are probably two, if not more species. I describe only one at present.

Dictyocaris, n. g., 1860.

Carapace ample, bent along the dorsal line, but not two-valved, largely reticulate, the area of the reticulations being convex.

The shape of the carapace is rudely triangular, pointed or rounded in front, truncate and produced behind, and margined along the hinder and ventral edges by a strong furrow. Body —— ?

In this giant Phyllopod, the two laminæ (inner and outer surfaces) of the carapace are clearly separable from each other. Both show the coarse reticulation. The anterior end, though evidently attenuated, is not perfect in our specimens; and I can only provisionally give a restoration of the form at *a*. A fragment of the surface is added, natural size and magnified, to show the coarse reticulations.

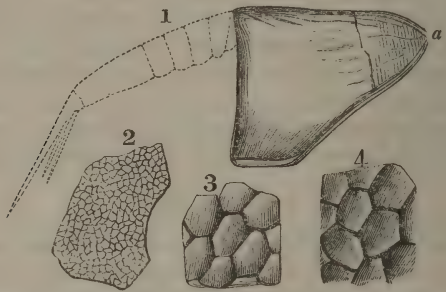


Fig. 1. *Dictyocaris*, about $\frac{1}{8}$th natural size. The body is a restoration.
Fig. 2. The surface, natural size.
Fig. 3. Ditto, magnified, external: the areæ convex.
Fig. 4. Cast of ditto upon the stone: the areæ concave.

D. Slimoni, n. sp.

D. magnus, sesquipedalis et ultra. Cephalothorax triangulatus. Segmenta corporis —— ?

Locality. Upper and Lower Ludlow rock, Lesmahago, Lanark. Very abundant in the latter formation, but chiefly in fragments.

Another species (if not more) occurs in the Ludlow rocks of the Pentland Hills, where it was found last summer by myself, in company with A. Geikie, Esq., of the Geological Survey of Scotland. I propose to call it *D. Ramsayi*. It will be described in the Memoirs of the Geological Survey.

This genus is more like *Nebalia* than is *Ceratiocaris*, inasmuch as it has a simply bent, not bivalved, carapace. But without the telson and other parts it cannot be associated with that group, and must for the present be placed near to the *Ceratiocaridæ*.

XVI.—*On the* Aphanarthra *of the Canary Islands.* By T. Vernon Wollaston, M.A., F.L.S.

The little genus *Aphanarthrum* was established by myself in 1854 (*vide* Ins. Mad. 292, tab. vi. f. 2) to contain a minute and curiously-coloured Coleopterous wood-borer which I detected, in the summer of 1850, at a very lofty elevation in the mountains of Madeira. This insect was attached exclusively to the gigantic *Euphorbia mellifera*, Linn. fil.; and I described it under the name of *Aphanarthrum Euphorbiæ*. Two separate sojourns, however, subsequently, in the Canaries, which may be called the region of Euphorbias, gave me an opportunity of examining carefully the rotten stems of the various members of that singular genus of plants, so largely represented in those islands; and I consequently soon perceived that there were many species of *Aphanarthrum*,—all of them remarkably well defined and never merging into each other, but more or less moulded on the same pattern, ornamented by modifications of the same anomalous tints, and deriving their entire subsistence from the branches of the decaying Euphorbias which abound on the mountain-slopes of intermediate altitudes throughout the whole seven islands of the Canarian archipelago. Whilst some of the *Aphanarthra* would appear to infest, almost equally, several kinds of Euphorbias, and to live in company (often in the utmost profusion), others seem to be confined to particular ones; and what I propose in the following paper is, to describe the nine species which have been hitherto discovered in the Canaries, and to point out the exact Euphorbias on which they, each of them, subsist. I may, however, first state that, having thus obtained an insight into their modes of life, I commenced a search at Madeira also, during the spring of last year, in the stems of the *E. piscatoria* of lower altitudes; and, in conjunction with my friends Mr. Bewicke and Señor Moniz, obtained two additions to the fauna of that island, both of them identical with the Canarian ones,—the *E. piscatoria* being alike distributed over the Madeiran and Canarian groups. Hence, up to the present date of our researches, we have, in all, ten species of *Aphanarthrum* (if indeed the first and last of the nine here enumerated have not eventually to be treated as generically separate),—two of which are common to Madeira and the Canaries, whilst one (the *A. Euphorbiæ*) is peculiarly Madeiran, and seven are peculiarly Canarian.

Fam. **Tomicidæ.**

Genus Aphanarthrum.

Woll., Ins. Mad. p. 292, tab. vi. f. 2 (1854).

1. *Aphanarthrum luridum*, n. sp.

A. lurido-testaceum, pilis longiusculis suberectis sparse vestitum;

prothorace sublævi punctulato, antice minus producto nigrescente, linea dorsali et stigmate utrinque posito plus minus nigrescentibus; elytris leviter seriatim punctulatis et transversim rugulosis, postice leviter truncatis, plaga discali nigrescente (in singulo posita) ornatis.—Long. corp. lin. 1.

Habitat in ramis emortuis *Euphorbiæ canariensis* in ins. Teneriffa et Gomera, hinc inde frequens.

In their somewhat larger size, the present species and the following one differ from the other *Aphanarthra* here described. The *A. luridum* may be known by the pale lurid-testaceous hue of its entire upper surface, with the exception of a longitudinal dash on each of its elytra, and the dorsal line of its prothorax (together with a spot on either side of the latter, and a suffused portion in front), which are alone more or less dark. Its prothorax is very much less produced over the head than in the other species, its punctation is extremely fine and minute, and its elytra are perceptibly shortened, or obliquely truncated, at their apex. It appears to be peculiar to the *Euphorbia canariensis,* in the rotten stems of which I have taken it plentifully on the mountains above S^ta^ Cruz in Teneriffe, and on a hill-summit to the north-west of San Sebastian in Gomera.

2. *Aphanarthrum Jubæ,* n. sp.

A. fusco-nigrum, pilis longis subdepressis mollibus dense vestitum; prothorace subrugoso punctato, antice producto sublurido necnon ad apicem ipsum tuberculis duobus prominulis instructo; elytris subseriatim punctatis et transversim rugulosis, testaceis, fasciis duabus profunde dentatis nigris (una sc. magna in medio duplici et altera angustiore subpostica) ornatis.—Long. corp. lin. $1–1\frac{1}{8}$.

Habitat in ins. Lanzarota, in ramis desiccatis *Euph. Regis Jubæ* prope oppidum Haria a meipso A. D. 1859 copiose repertum.

The extremely pubescent surface of this large species, in conjunction with the small but distinct tubercles in the middle of the anterior edge of its prothorax (the two central ones of which are very evident), will, apart from its colouring as defined above, at once characterize it. It was detected by myself, during March of 1859, in great abundance, amongst a pile of dried stems of the *Euph. Regis Jubæ,* at Haria, in the north of Lanzarote.

3. *Aphanarthrum canariense,* n. sp.

A. latiusculum, fusco-nigrum, pilis brevissimis parce vestitum; prothorace subconvexo alutaceo granulato, antice producto lurido necnon ad apicem ipsum acuminato incrassato (fere subrecurvo); elytris dense seriatim punctatis et transversim rugulosis, brunneo-testaceis, fascia dentata magna media nigra (plus minus suffusa) ornatis.—Long. corp. lin. $\frac{3}{4}–\frac{7}{8}$.

Habitat in ramis putridis *Euph. canariensis* in ins. Canaria, Teneriffa, Gomera, Palma et Hierro, vulgare.

The just perceptibly broader and shorter outline of this species

(in proportion to its size), together with its extremely short pubescence, its dense (but not very coarse) elytral sculpture, and the much acuminated apex of its prothorax, which is very perceptibly thickened (with a slight tendency to be recurved) at its extreme point, will serve to characterize it. The testaceous portions of its elytra are browner than in the other *Aphanarthra* (except the *A. bicinctum*) here described; the hinder elytral fascia is obsolete, and the anterior one is broad and more or less suffused, and with its central loop continuous and well defined —not being broken up into two separate portions. It seems principally, if not indeed entirely, attached to the decayed stems of the *Euph. canariensis*, under which circumstances I have captured it in Grand Canary, Teneriffe, Gomera, Palma, and Hierro.

4. *Aphanarthrum bicinctum*, n. sp.

A. fusco-nigrum, pilis sat brevibus vestitum; prothorace alutaceo dense granulato, antice producto vix pallidiore; elytris seriatim punctatis et transversim rugulosis, brunneo-testaceis, fasciis duabus dentatis nigris (una sc. magna et altera angustiore subpostica) ornatis.—Long. corp. lin. $\frac{2}{3}$–$\frac{3}{4}$.

Habitat in ramis emortuis *Euph. balsamiferæ* in ins. Lanzarota et Fuerteventura, vulgare.

In the *brownish* testaceous hue of the lighter portions of this insect, and the unbroken form of its front elytral fascia, it agrees with the *A. canariense.* It is, however, much smaller than that species, its pubescence is not quite so short, its hinder elytral fascia is developed, and the apex of its prothorax is usually darker and much less acuminated. Its habits also are different; for whilst that insect is apparently confined (or, at any rate, nearly so) to the *Euph. canariensis*, the *A. bicinctum* is attached principally to the *E. balsamifera* (and, I believe, also, though more sparingly, to the *E. Regis Jubæ*), in the stems of which I have taken it abundantly both in the north of Lanzarote and near the town of S^ta^ Maria Betancuria in Fuerteventura.

5. *Aphanarthrum bicolor*, n. sp.

A. pallido-testaceum, subdiaphanum, pilis paucis erectis remote vestitum; prothorace subtilissime alutaceo sparse et minute punctulato, antice producto necnon ad apicem ipsum acuminato incrassato, linea dorsali, macula transversa subpostica et linea transversa subantica (plus minus confluentibus suffusis) nigris; elytris remote seriatim punctulatis (punctulis minutis), fasciis duabus profunde dentatis nigris (una sc magna in medio duplici et altera angustiore subpostica) ornatis.

Variat lineis maculisque plus minus fractis, disjunctis, rarius subobsoletis.—Long. corp. lin. $\frac{3}{4}$–1.

Habitat in ins. Teneriffa, Gomera et Hierro in ramis Euphorbiarum emortuarum (precipue *E. piscatoriæ*), sat frequens.

A most distinct and beautiful *Aphanarthrum*, readily known

by its pale whitish-testaceous hue, diaphanous (or subhyaline), slightly shining, almost unpubescent, and most lightly punctured surface, and by the quantity of dark patches and broken fasciæ with which it is ornamented. It occurs in the dead branches of (I believe principally) the *Euph. piscatoria,* under which circumstances it was taken by myself in Teneriffe and Palma, and by Mr. Gray and myself in Hierro. I have likewise captured it, from out of the stems of the same plant, in Madeira,—where, however, the specimens have their elytra a trifle more distinctly punctured, and the interstices somewhat more roughly alutaceous, or shagreened.

6. *Aphanarthrum affine.*

A. angustulum, fusco-nigrum, pilis suberectis sat dense vestitum; prothorace alutaceo punctato granulato, antice producto lurido necnon ad apicem ipsum leviter acuminato incrassato; elytris seriatim punctatis, testaceis, fasciis duabus profunde dentatis nigris (una sc. magna in medio duplici et altera angustiore subpostica) ornatis.—Long. corp. lin. $\frac{2}{3}$–vix $\frac{7}{8}$.

Habitat in ramis emortuis Euphorbiarum in ins. Lanzarota, Fuerteventura et Canaria, hinc inde frequens.

This species and the following one are a good deal allied; the *A. affine,* however, is rather larger and a little less densely pubescent, and its elytra are somewhat more parallel and less closely sculptured, the punctures being more evidently arranged in rows than is the case with the *A. piscatorium.* Its elytral fasciæ, also, are much more distinct; and the anterior one is more decidedly double in its central region, like that of the *A. Jubæ, bicolor,* and *glabrum.* It was taken abundantly by Mr. Gray and myself, out of the *Euph. balsamifera,* in the north of Lanzarote, and by myself at Betancuria in Fuerteventura, as well as (out of the *E. piscatoria*) at El Monte in Grand Canary. It is a good deal allied, in general facies, to the Madeiran *A. Euphorbiæ*; nevertheless it is slightly smaller than that insect, its pubescence is longer, its prothorax less acuminated in front, and its elytral punctures are much larger, fewer, and more evidently disposed in rows.

7. *Aphanarthrum piscatorium,* n. sp.

A. fusco-nigrum, pilis suberectis dense vestitum; prothorace alutaceo dense punctato, antice producto leviter acuminato sublurido; elytris dense subseriatim punctatis et transversim rugulosis, dilute testaceis, fasciis duabus profunde dentatis nigris (una sc. magna et altera angustiore suffusa postica) ornatis.—Long. corp. lin. $\frac{2}{3}$–$\frac{3}{4}$.

Habitat in ins. Teneriffa, Palma et Hierro, in ramis *E. piscatoriæ* emortuis, ubique vulgare.

A rather insignificant little species, closely allied to the last one. It may be known from it, however, by its smaller size and

somewhat more pubescent surface, by its elytra being just perceptibly less parallel, more densely sculptured, and with their punctures much less evidently disposed in rows, and by its elytral fasciæ (the front one of which is simple, or at any rate less clearly disjointed in the centre) being (especially the hinder one, which is usually continued to the very apex) less distinct. I found it tolerably common, in the decayed stems of *Euph. piscatoria*, in Teneriffe, Palma, and Hierro,—in the last of which islands it was also captured by Mr. Gray. It likewise occurs, attached to the same plant, in the lower elevations of Madeira.

8. *Aphanarthrum glabrum*, n. sp.

A. fusco-nigrum, fere pilis carens; prothorace dense alutaceo punctato, antice producto leviter acuminato subincrassato (fere bituberculato) sublurido; elytris leviter subseriatim punctatis, testaceis, fasciis duabus profunde dentatis nigris (una sc. magna in medio duplici et altera angustiore subpostica) ornatis.—Long. corp. lin. $\frac{2}{3}$–vix $\frac{3}{4}$.

Habitat in ramis truncisque Euphorbiarum in ins. Hierro, rarius.

The almost total freedom from pile (except under a high magnifying power) of this little *Aphanarthrum*, in conjunction with its very lightly sculptured elytra (the punctures of which are but indistinctly disposed in rows), will, *inter alia*, readily separate it from any of the preceding species. It appears to be rare, the only specimens which I have yet seen having been captured by myself in the island of Hierro.

9. *Aphanarthrum pusillum*, n. sp.

A. minutum, nigro-fuscum, pilis cinereis vestitum; capite leviter elongato subporrecto; prothorace angustulo subelliptico punctato, antice leviter producto et subito contracto acuminato; elytris dense subseriatim punctatis, concoloribus, ad humeros in tuberculum indistincte elevatis; antennis pedibusque pallidioribus.—Long. corp. lin. $\frac{1}{2}$–vix $\frac{2}{3}$.

Habitat in ramis *Euph. canariensis* putridis, in ins. Canaria, Teneriffa et Gomera, a meipso repertum.

The excessively minute size and uniformly dark-brown hue of this little *Aphanarthrum*, in conjunction with its rather elongated subporrected head and its somewhat elliptic, anteriorly contracted prothorax, will at once distinguish it from any of the preceding species. It is possible, indeed, that it may eventually form the type of an allied genus; but, as I have not yet attempted to dissect it, or to examine its antennæ microscopically, this is a question I must decide hereafter. It appears to be peculiar to the *Euph. canariensis*, in the rotten stems of which I have captured it in Grand Canary (in the great crater of the Bandama), Teneriffe (on the mountains above S^{ta} Cruz) and Gomera (on a hill-summit to the northwest of San Sebastian).

XVII.—*Description of* Uriëchis microlepidotus, *a new Snake from South Africa.* By Dr. A. Günther.

[With a Plate.]

Professor Peters of Berlin has made known* a genus of *Calamaridæ* with entire subcaudal shields, to which he has given the name of *Uriëchis*, and which is distinguished from *Elapops*, Gthr., by having a long, grooved, posterior maxillary tooth. In describing the latter genus† I took the opportunity of showing the frequent occurrence of snakes with entire subcaudals in the Palæotropical Region; but I then overlooked *Uriëchis*, the two species of which (*U. nigriceps*, and *U. lunulatus*) have been found, up to the present time, in Mozambique only. I have the pleasure of adding a third species from Port Elizabeth, in Algoa Bay, presented by F. H Gurney, Esq., to the British Museum.

Uriëchis microlepidotus. (Plate IX.)

Diagnosis.—Scales in twenty-five longitudinal series; præorbital united with the frontal. Colour uniform blackish ash.

Description.—This snake is in general appearance very similar to *Elapops* or *Atractaspis*. The rostral is broader than high, and reaches just to the upper surface of the head, terminating above in an obtuse angle. The exterior frontals are subquadrangular, half the size of the posterior ones, which, being united with the præorbital, are bent downwards and extend to the orbit and the third upper labial. The vertical is five-sided, with a posterior right angle, with the anterior side longest, and the two lateral edges shortest: the shield is about as broad as long. The occipitals do not show any peculiarity in form. The superciliary is small, not much longer than broad. There is one elongate nasal only, with the nostril at its upper margin; a groove below the nostril appears to divide the shield into two, which, on a closer examination, is found to be single. One small posterior ocular. Seven upper labials, the third and fourth of which enter the orbit, which is very small; the fifth touches the occipital in the adult specimen, being separated from it in the young one. There are three temporal shields, the anterior being the largest; another shield is situated on the posterior edge of the occipital. The first pair of the lower labials forms a suture behind the median one, which is very small; there are two pairs of chin-shields, the posterior being rather smaller than the anterior. Eight lower labials. The trunk is surrounded by twenty-five scales; there is a series of larger scales along the middle of the upper part of the tail, but not yet distinct in the

* Wiegm. Archiv, 1855, p. 52.

† Ann. & Mag. Nat. Hist. 1859, ser. 3. vol. iv. p. 161.

C.H.Ford

W.West imp

URIECHIS MICROLEPIDOTUS. *Gthr.*

young specimen*. There are 166 ventral, 1 entire anal, and 50 caudal plates.

The colour is uniform blackish-ash, or black if the epidermis is lost.

The series of teeth are very short; that of the maxillary bone is formed by three smaller ones and a very long and grooved posterior one.

The larger of the two specimens is an adult female, 3 feet 1 inch long; the head is 13 lines, the tail 6 inches. It contained mature eggs, $1\frac{1}{2}$ inch long, without any trace of an embryo.

Mr. Gurney's correspondent adds the following note:—

"The Caffre name for this snake is 'Amafoosamanzi'; it was ploughed up by my man, and the eggs were ploughed up close to it; but whether both† or either of them belong to the snake I cannot say. The Caffres say that it is one of the most poisonous here (?), and that a person bitten by one would die in a few minutes, unless strong remedies could be applied."

XVIII.—*Description of* Leptodeira torquata, *a new Snake from Central America.* By Dr. A. Günther.

[With a Plate.]

Two subdivisions may be distinguished among the snakes which I have comprised in the family of *Dipsadidæ*: the one has the body elongated and slender, evidently living chiefly on trees; whilst the other more nearly approaches the *Coronellidæ*, having the body rather stout, and not compressed, and these live on dry ground.

The genus *Leptodeira*, in which I have grouped *Coluber rufescens*, Gm., from South and West Africa, and *Coluber annulatus*, L., from the tropical parts of the American continent, is that which is truly intermediate between the two families mentioned, having entirely the habit of *Coronella*, but with the head remarkably broad and depressed, and the pupil elliptical and erect, as in *Dipsas*, like which they are probably nocturnal animals. Though always directing my attention to the generic differences which exist between animals from different geographical regions, I have not been able to find any between the African and South American species of *Leptodeira*. It is true that Duméril has

* The presence of a series of larger scales on the back of the tail cannot form a generic character.

† The eggs sent with the snake belong to two species, different in size. The larger ones, apparently belonging to the present species, contained embryos in the first stage of development.

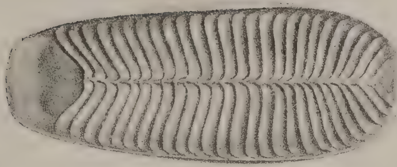
separated the former, referring it to a genus which he calls *Heterurus*, because the subcaudal plates are said to be partly simple and partly bifid. This, however, must be merely accidental in some individual, and an exception, all the specimens which I have examined (and their number is nearly fifty) showing invariably all the subcaudals bifid. A character which I should have been glad to admit into the generic diagnosis of *Leptodeira* was the presence of a posterior grooved tooth; but this character must now fall to the ground, according to my view,—the species which I am about to describe exhibiting the posterior tooth smooth, although strong. It is so similar to *Leptodeira annulata* that, at the first glance, one might be tempted to pronounce it merely a variety in which the neck, usually of a light brown colour in *L. annulata*, has become white. The specific difference, however, may be easily proved by a closer examination, when they will appear in the same relation to each other as *Coronella lævis* and *Coronella cucullata*. According to Duméril's system, the new species would enter the genus *Liophis*.

Leptodeira torquata. (Plate X. A.)

Diagnosis. Anal bifid. Scales in twenty-one rows. Posterior maxillary tooth longest and strongest, and separated from the others by an interspace. Brownish grey, with a vertebral series of brown spots, some of which are confluent into a zigzag band; neck with a white collar.

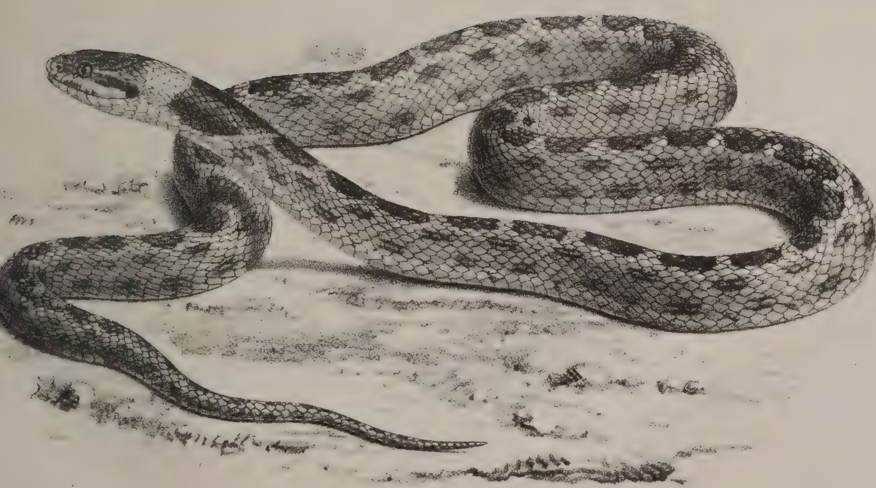
Habitat. Nicaragua; Island of Laguna. The two typical specimens are in the Derby Museum at Liverpool.

Description. The head is rather broad and depressed, the snout rounded; the eye is of moderate size, its vertical diameter being about one-third the width between the eyes; the trunk is rounded, the tail of moderate length, or rather short. The rostral reaches to the upper surface of the snout; the anterior frontals are nearly square, and much smaller than the posterior ones, which, broader than long, are bent downwards to the side of the snout; the vertical is pentagonal, longer than broad, and of somewhat different form in the two specimens; the occipitals are rounded posteriorly. Nostril situated between two nasals; loreal square; two anterior oculars, the lower of which is small, and intercalated between the third and fourth labial shields; two posterior oculars; eight upper labials, the fourth and fifth of which enter the orbit. There is one elongate temporal shield in contact with both the oculars; the other temporals, five in number, are scale-like. The medial lower labial is triangular, and rather small; nine lower labials, the first of which is in contact with its fellow behind the median shield. There are two pairs



B

A.



C.H.Ford. W.West imp.

A. Leptodeira torquata, *Gthr.* B. Echeneis scutata, *Gthr.*

of chin-shields, the anterior of which is somewhat the larger. The scales are in twenty-one rows, rhombic, those of the sides similar to those on the back. The number of the ventral plates is in both snakes the same, viz. 174; that of the caudals varies between 44 and 56.

The ground-colour of the upper parts is brownish olive: the head is speckled with brown, and a brown streak runs from the eye to the angle of the mouth. The neck is surrounded by a white or yellowish-white collar, bordered posteriorly by a large brownish-black blotch; there is along the middle of the back a series of brown spots, some of which are confluent into a zigzag band; two or three series of small spots run along each side. The lower parts are uniform white.

	A.		B.	
	inch.	lin.	inch.	lin.
Total length	17	9	16	5
Length of the head	..	6	..	5
Greatest width of the head	..	5	..	4
Length of the trunk	15	0	13	0
Length of the tail	2	3	3	0

One of the specimens has been brought from Nicaragua, the other from the island of Laguna, together with *Herpetodryas Rappii* and *Tomodon strigatus*. Therefore the native country of the typical specimen of the latter species appears to be incorrectly stated*, and *Tomodon* holds good as a truly neotropical genus.

XIX.—*Descriptions of two British Spiders new to Science.* By the Rev. O. P. Cambridge, B.A.

Tribe Octonoculina.

Family Drassidæ. Genus Drassus.

Drassus clavator.

Male adult.—Length $\frac{1}{4}$ of an inch; length of cephalothorax $\frac{1}{7}$; relative length of legs 4, 1, 2, 3.

The distinguishing characteristics of this species seem to be, *its medium size; the golden coppery and silky hue; the close contiguity of the two central eyes of the posterior row; the two curved lines formed by the six pale spots on the abdomen; and the large-sized, long-oval, club-shaped digital joint of the palpi.*

A more minute description is as follows:—

Cephalothorax longish oval, and clothed sparingly with fine hairs; slightly truncate at the region of the eyes, but sloping

* Gthr. Catal. Colubr. Snakes, p. 52, where the snake is said to come from India. The pupil of *Tomodon strigatus* is round.

gradually from the centre to the abdomen. *Colour* pale yellowish brown, with some fine black lines, or rather furrows, diverging on all sides from a point near the centre, terminating short of the lateral margin; these lines are connected imperfectly by another similar line parallel to the margin, and running interruptedly quite round the cephalothorax, the two ends losing themselves in the region of the eyes. Lateral margin bounded by a fine black line.

Eyes eight, in two parallel curved rows on edge and front of the cephalothorax; convexity of the curve directed backwards; anterior row the shortest. Colour pale porcelain, shining and transparent; the two centre ones of the posterior row largest of the eight, and *touching each other*, the touching side flattened: two exterior ones of the same row round, prominent, seated on a small tubercle, and with a black rim on the inner sides; two exterior eyes of anterior row round, of intermediate size between those of the posterior row, and with black rims on the upper side; two centre ones of anterior row smallest of the eight, round and prominent.

Legs robust, slightly paler than the cephalothorax; thickly clothed with hairs of the same hue, and a few black spines; the hairs on the *last joint* of the legs are nearly white.

Palpi hairy, long, and same colour as the legs; digital joint *very large, long, oval, club-shaped,* brown and hairy.

Falces same colour as the cephalothorax; the fang red brown.

Maxillæ curved inwardly and towards the labium, and similar in colour to the legs.

Labium oval, pointed at the top, raised along the medial line, and, with the sternum, which is slightly heart-shaped, of a yellowish-brown colour, considerably darker than the legs, &c.

Abdomen longish oval, dark brown, with a silky gloss in strong light; thickly clothed with yellowish hairs, giving a *golden coppery hue* in many positions. *On the upper side,* these hairs, by differences of length and hue, show *six elongated pale yellowish spots, arranged near the upper end of the abdomen in two longitudinal rows of three each, and curved from each other.* (These spots are especially visible when in spirits of wine.) Next to these, towards the spinnerets, are formed in the same way *seven angulated lines* of the same colour, the vertices directed forwards. These lines do not nearly span the abdomen, but decrease in length as they approach the spinnerets. The *spinnerets* are six in number, the two *superior* ones double the length of any of the others, hairy, and all of same colour as the legs; as are also the plates of the spiracles.

An immature female of this species differed only in being

smaller, in the relative lengths of the spinnerets, and in having the space between the six spots on the upper side of the abdomen *dark brown,* forming a long pointed-oval marking, reaching to the vertex of the first angulated line.

The adult male above described was taken by myself in April 1859, by raking with a crooked stick along the rooty ledges in the sand-hills at Southport, Lancashire, on the north side of the town. It was very active, and bit fiercely when seized. I have since captured immature specimens among moss and grass on the same sand-hills: and later still (in Oct. 1859), I found both sexes, in a state of immaturity, plentiful under stones and detached pieces of rock in the Isle of Portland, where they are very difficult to capture, as they slip from the fingers and among the stones like little eels. The immature female mentioned above was captured by myself under a stone on Kirkby Moss, near Liverpool, in June 1859.

Family Linyphiidæ. Genus Walckenaëra.

Walckenaëra aggeris.

Length $\frac{1}{16}$ of an inch; breadth $\frac{1}{32}$.

The distinguishing characteristics of this species seem to be, *the pale joints of the legs; the boldness and obtuseness of the frontal eminence; the indentations behind the lateral pairs of eyes; the forehead clothed with hairs, and the form of the palpi and palpal organs.*

The following is a more minute description:—

Cephalothorax large, black, and shining: *frontal prominence broad, bold, and obtuse,* sloping slightly from the top towards the falces; *an oblong vertical space between the front and back pairs of eyes thickly clothed with hairs.* It has no indentation in the medial line, *but has one directed backwards from each lateral pair of eyes.* In females, the cephalothorax is smaller and the prominence less bold than in males.

Eyes in *four pairs,* situated one on the top of the eminence, another on the front below, and a pair on each side of it, forming the four sides of a square.

Legs moderately robust, thickly clothed with short hairs; bright yellowish red-brown, *much paler at the region of the joints.*

Palpi and *maxillæ* same colour as the legs; extremity of the radial and digital joints brownish black. The radial, which is stronger than the cubital joint, is produced at its extremity in front, and has a sharp projection on its outer side. *Digital joint* oval, with a small lobe near its extremity on the outer side.

It is convex and hairy externally, concave within, where the palpal organs are highly developed, prominent, and complicated, and of a reddish-brown colour.

Falces moderate-sized, convex, and same colour as the maxillæ. *Sternum* large, prominent, and heart-shaped, and, together with the *labium*, black.

Abdomen slightly hairy, shining, oval and *very convex* on the upper side; it projects considerably over the base of the cephalothorax. Colour, in adult males, *jet black*; in adult females, black, with at times a greenish-brown hue, and in some specimens with a few pale angulated lines towards the apex of the abdomen, the angles directed forwards. Immature individuals are often greenish black, with legs dirty greenish brown, *paler* at the joints.

Adult males and females of this species were discovered by myself in abundance, during the summer of 1859, at the roots of grass and underneath rubbish on dry bank-sides, near Church Town, Southport, Lancashire.

XX.—*On the Nomenclature of the* Foraminifera. By W. K. Parker, M. Micr. Soc., and T. R. Jones, F.G.S.

[Continued from p. 116.]

24. Nautilus Spengleri. Five varieties. Page 84. Fichtel and Moll make the following appropriate references:—Linn. Syst. Nat. xiii. Gmel. p. 3371. no. 10: Spengler, Schrift. dän. Gesellsch. Kopenh. vol. i. p. 373, pl. 2. fig. 9 *a b c*: Schröter, Einleit. Conch.-Kennt. vol. i. p. 756; Neue Literat. u. Beytr. z. Naturg. vol. i. p. 309, pl. 1. figs. 3–6; Schreibers, Conch. Kenntn. vol. i. p. 5. no. 10.

α. Pl. 14. figs. *d–f*.
β. Pl. 14. figs. *g–i*.
γ. Pl. 15. figs. *a–c*.
δ. Pl. 15. figs. *d–f*.
ε. Pl. 15. figs. *g*, *h*.
Pl. 15. figs. *i*, *k*, sections.

"Recent: from sand in a *Buccinum cassideum* (Gmelin) from the East Indian Sea; and from the Red Sea."

This belongs to the Rotalian group; the shell is unsymmetrical, like the other *Rotaliæ*, and is marked by an extensive growth of exogenous granular shell-matter. This luxuriant shell-growth is shown also in the very variable rays or spines, which, commencing near the umbilicus in the septal interspaces, advance outwards often to a considerable distance (equal even

to the width of the shell) from the periphery. The cell-growth also often becomes wild, the later chambers irregular and heaped, being outspread on the granulated surface of the upper side. The rough and prickly surface is a very constant character in this *Calcarina*, although some very minute forms show it only in an umbilical boss and a prickle on the periphery of each chamber. What seems to be a large aperture in these figures arises from the fracture of the newest chamber, which is, until well coated with exogenous matter, extremely thin. In well-preserved specimens of the typical forms we find that the real aperture, which is essentially a slit, as in the true *Rotaliæ*, becomes bridged over by delicate bars of shell-matter. *Calcarina* is a subgenus of *Rotalia*, characterized by its excessively spinous coating and cribriform aperture. In its spines, in the copiousness of its exogenous matter (which is tubuliferous), and in its generally cribriform aperture, it affords us an analogy to the *Polystomella crispa*; whilst other *Rotaliæ* have on their part a corresponding analogy to the smooth-shelled *Nummulina* and *Amphistegina*. *Rotalia Beccarii*, often prickly and even spinous, is the linking form between *Calcarina Spengleri* and the ordinary *Rotaliæ*, and at the same time is rich in varieties isomorphous with many conditions of *Polystomella*.

Rotalia (*Calcarina*) *Spengleri* is found in all warm seas. This is the *Siderolites calcitrapoides* of Lamarck, and *Siderolina lævigata*, D'Orb., both from Maestricht. The latter is Fichtel and Moll's var. ε.

25. Nautilus repandus. Page 35, pl. 3. figs. *a–d*. "Recent: zoophytic concretions, Mediterranean."

This is a true *Rotalia*, and is a typical form of a large number of varieties which have their cells numerous but very variable in their convexity,—so much so that they often produce a much more expanded shell than the one here figured, and even irregular in growth; on the other hand, they may become contracted and few-celled, forming a thick conical shell. The aperture is usually a large slit at the base of the last chamber; but in some of the more compact forms, in which the chamber-walls are flush, the aperture passes into the condition of a notch: hence the forms of aperture once supposed to be respectively characteristic of *Rosalina* and *Rotalia* are in this species shown to be non-essential. The specimen figured by Fichtel and Moll is probably not very well drawn; for in specimens of similar size and form we find the spire better marked.

A flatness of the septal face is a very usual feature in this species.

This is a world-wide species in its typical condition; and its many varieties are equally abundant and common. In deep

water this species is represented by the variety *Rotalia Menardii,* D'Orb., which is flattish, limbate, and granular, and has for companions the contracted varieties *R. Micheliniana,* D'Orb., *R. crassa,* D'Orb., and *R. nitida,* Reuss, together with intermediate forms. In shallower water, especially on muddy bottoms, we find large, smooth, flush-chambered and more or less limbate forms, such as *R. Partschiana,* D'Orb., and *R. Schreibersii,* D'Orb.; but the former of these is often found at great depths.

In the Laminarian zone this species often takes on an irregularity of growth, many of the latter chambers elongating themselves without septa. Thus (becoming almost as simple as *Spirillina vivipara,* Ehrenberg) it becomes the *Planorbulina vermiculata,* D'Orb., Ann. Sc. Nat. vol. vii. p. 280.

The two varieties of this species represented by D'Orbigny in his 'Modèles,' No. 12 (*R. punctulata,* D'Orb.) and No. 10 (*R. pulchella,* D'Orb., which is the same as *R. Caribbæa,* D'Orb.), must be placed very close to the typical *R. repanda* (which, indeed, is intermediate between these two).

In this species the shell is for the most part very finely pored; but when the septal face is much flattened, or the shell takes on a wild growth, a number of large holes give a punched aspect to the septum; and even, in the vermiculate forms, the whole of the under surface of the shell is thus coarsely pertused.

Varieties of this species occur fossil as far back as the Upper Trias, in nearly all the clays of the Oolites, in the Gault and Chalk, and throughout the Tertiaries. It may be found in all seas; and we have it from the Tropics, brought up from 2700 fathoms (Capt. Pullen's soundings).

26. Nautilus sinuatus. Page 65, pl. 10. figs. *a–d*. "Fossil: San Quirico in the Siennese."

This is a small-sized variety of the *Rotalia repanda.* It is more margined and flattened; it is limbate on some of the septal lines. The early part of the spire is hidden here by granules. This ornament is seen in other varieties on the upper and occasionally on the under surface. The different degrees of ornament produced by exogenous shell-growth in the margins, in limbation, and in granulation, scarcely permit us to find two specimens alike, to say nothing of the variability as to the size and thickness of the shell and the number of chambers. Still the species has a habit of its own, with a peculiar setting-on of the chambers, and style of ornament, which help us to see a specific relationship between forms at first sight very different, and at the same time to recognize limiting distinctions between the most aberrant forms and their isomorphs belonging to other species.

D'Orbigny's Model No. 71 (*Rotalia pulchella,* D'Orb.) is one of the nearest to this variety (*R. sinuata*), which is world-wide.

27. Nautilus Auricula. Page 108. Var. *α*. pl. 20. figs. *a–c.* "Soldani, Testaceogr. vol. i. pl. 50. fig. Y." "Fossil: Coroncina."

Var. *β*. pl. 20. figs. *d–f.* "Recent: zoophytic concretions, Mediterranean."

These are delicate oblong varieties of *Rotalia repanda,* with rapidly increasing chambers. They bear the same relation to their type as *Nonionina Scapha* does to *Nonionina asterizans* and *Polystomella crispa.*

The intermediate links between the typical *R. repanda* and *R. Auricula* are found in the less oblong forms common in some of the Subapennine Tertiary beds, such as those of Palermo and Turin: in these a part only of the septal face is flattened and drilled with very coarse foramina, the rest remaining slightly gibbous and finely perforated; whilst in many other varieties of *R. repanda* the septal face is uniformly flat and pertused, for instance *R. Caribbæa,* D'Orb., and *R. pulchella,* D'Orb. In *R. Auricula* and its immediate congeners the whole septal face is more or less convex and delicately porous.

Some of these oblong varieties have been (as Professor Williamson has already noticed) erroneously grouped under the genus *Valvulina* by D'Orbigny; such as "V. æqualis," "V. oblonga," and "V. excavata."

In var. *α,* the outline is more entire, and the chambers less vesicular than in var. *β*. These belong to a very variable group of small elongate varieties of *R. repanda.* Var. *α* is intermediate between *R.Hauerii,* D'Orb. (For. Foss. Vien. pl. 7. figs. 22–24) and *R. Brongniartii,* D'Orb. (*op. cit.* pl. 8. figs. 22–24). Var. *β* approaches very closely to Williamson's *Rotalia oblonga* (Monogr. pl. 4. figs. 98–100); the latter, which is larger but less gibbous than var. *β,* attains its finest development in the English Channel and the Bay of Biscay, at from 50 to 70 fathoms; but similar varieties, though generally smaller, are to be met with in nearly every Foraminifer-bearing sea-sand or mud, at variable depths, and are rather common in almost all Tertiary deposits.

28. Nautilus farctus. Page 64, pl. 9. figs. *g–i.* "Fossil: Coroncina, near Sienna, Tuscany."

The shell here figured is essentially a plano-convex *Rotalia;* but in the further developments which varieties of this species exhibit we have characters presented that make it very convenient to divide the forms of this group (as well as those of another *Planorbulina,* typified by *Rosalina Poeyi,* D'Orb.) from the ordinary *Rotaliæ.* For this subdivision the well-known name *Planorbulina* is retained, which was used generically by D'Or-

bigny for the outspread many-celled varieties of *Nautilus farctus**. The common *Truncatulina lobatula*, Walker, is a simple form of this type, arrested, as it were, in its development; and many of the little so-called *Rosalinæ, Rotalinæ, Anomalinæ*, and *Planulinæ*, are equally simple dwarf forms; their relative vesicularity or complanation being due to accidental style of growth and place of attachment, whether it be sea-weed, rough or smooth shell, or other substance. The depth of water, also, and character of the sea-bottom affect the growth of these very variable shells. Every collector knows the *T. lobatula*, with its white plano-convex shell, crenulate outline, slit-like aperture, and coarse perforations. Similar features, modified, characterize *Nautilus farctus*; this, however, is differentiated by some amount of limbation on the convex face, and by the greater height of the chambers. *Planorbulina nitida*, D'Orb. (Modèles, No. 78), is a similar form to the last mentioned, not markedly limbate, and having more chambers. *Pl. Mediterranensis*, D'Orb. (Ann. Sc. N. vol. vii. p. 280, pl. 5. figs. 4–6; and Modèles, No. 79), presents a further developmental step in the growth of these instructive varieties; for here we find the same morphological plan, with an increase of chambers, in a delicate and scale-like shell. In *Pl. vulgaris*, D'Orb. (For. Cuba, pl. 6. figs. 11–15), we have a coarser and somewhat biconvex shell, with a wilder mode of growth. The chambers become baggy and divergent, and present supernumerary lipped apertures. The more irregularly constructed shells of *Pl. vulgaris*, whether heaped into a little racemous mass, or ringing the smooth stems of sea-weeds, have been denominated *Acervulinæ* by Schultze. Arrested conditions of this biconvex variety constitute the *Anomalinæ* of D'Orbigny: amongst the thickest and most symmetrical of these is our *A. coronata* (Ann. Nat. Hist. ser. 2. vol. xix. p. 294, pl. 10. figs. 15, 16); whilst the thinnest and most outspread is the *A. Rotula*, D'Orb. (For. Foss. Vien. pl. 10. figs. 10–12). This last-named variety, elegant in its delicate symmetry, is subject, among other modifications, to a variable exogenous overgrowth on its septal lines, as, for instance, *Rosalina Edwardsiana*, D'Orb. For. Cuba, pl. 6. figs. 8–10, and *Truncatulina ornata*, D'Orb. For. de l'Amér. Mérid. pl. 6. figs. 7–9; and thus it insensibly loses itself in the subsymmetrical and strongly limbate *Planulina Ariminensis*, D'Orb. (Ann. Sc. Nat. vol. vii. p. 280, pl. 5. figs. 1–3, Modèles, No. 49.) In our already quoted paper on the Rhizopods of the Norway coast, we have erroneously placed *Pl. Ariminensis* among the synonyms of *Operculina complanata*, misled by its extreme similarity of shape.

Soldani has devoted many plates in his 'Testaceographia' to

* In his genus *Planorbulina*, D'Orbigny placed also some Spirilline varieties of *Rotalia repanda* (such as *Pl. vermiculata*).

figures of the very protean *Truncatulina variabilis*, D'Orb., a Mediterranean form exactly intermediate between the tropical *Planorbulina vulgaris* and *Nautilus farctus*, which we find recent in the Mediterranean and other seas. This noble work also affords numerous striking illustrations of the other varietal forms, differing in their extremes, yet blending by gentle gradations.

Nautilus farctus is a Planorbuline *Rotalia*, and is the type of the species comprehending the above-mentioned and many other varieties. Like *Rotalia repanda*, it represents the medium between extreme conditions; its discoidal growth and its high and well stuffed-out chambers give it good title to its name and systematic place. Whilst arrested, as compared with some of the extravagantly grown forms, it is much better developed than many of the varieties enumerated, presents indications of all its essential specific features, and keeps its subgeneric characters better than the trochiform varieties, some of which become, as it were, isomorphs of *Rotalia* proper, others of *Nonionina*.

29. Nautilus tuberosus. Page 111, pl. 20. figs. *g–k*. "Fossil: Coroncina."

This is a variety of *Planorbulina farcta*, with many chambers irregularly set on, and mostly narrow. This *Pl. tuberosa* has the biconvex form which chiefly characterizes D'Orbigny's *Anomalina*, and is intermediate to his *A. Badenensis* and *A. Austriaca*. This tuberose variety may be said either to represent an early stage of *Planorbulina vulgaris*, or to be a neatly growing and nearly symmetrical modification of *Truncatulina variabilis*. Like *P. farcta*, this variety is very common in the Mediterranean and other warm seas, and occurs in Tertiary deposits.

30. Nautilus planatus. Page 91. Three varieties. "Recent: Leghorn coast, Tuscany."

Var. *a*. Pl. 16. figs. *a–c* (*i*, section). "Schröter, Neue Literat. d. Naturgesch. vol. i. p. 314, pl. 1. fig. 7."

Var. *β*. Pl. 16. figs. *d–f*.

Var. *γ*. Pl. 16. figs. *g*, *h*.

This is "le Pénérople aumusse" (the *Peneroplis planatus*) of Denys de Montfort, and is a distinctly specific type of one of the opake-shelled Foraminifers. Commencing with a primordial double chamber, like that of the *Miliola*, *Orbiculina*, and *Orbitolites*, it soon takes on a Nautiloid growth; the aperture, at first single, margined, and irregular, soon becomes more irregularly trilobate in the successively enlarging triangular septal faces (as in *Dendritina*, where it is arborescent); in a further stage of the shell, the newer chambers are flat, narrow, and transversely long, spreading out with widening curve,—keeping a Nautiloid outline, as in var. *a*; becoming auricular or bonnet-shaped, as in var. *β*; or showing some modifications of the above, arising from an irregular periodicity of growth, as in var. *γ*. In other

forms, the shell grows on until the newest chambers extend in their curvature far back, even to three-fourths of a circle, as if they would take on a cyclical growth, such as is normal in *Orbiculina* and *Orbitolites*. In the broad, complanate, typical varieties, the septal face is necessarily very long and narrow, and is perforated by one or more rows of roundish or hourglass-shaped, thickly margined passages, subtubular and more or less ecto-ento-solenian. This condition is attained by the gradual lineation and subdivision of the lobulate and dendritine aperture. These broad forms are from the seaweed-belt of the warmer seas; but in somewhat deeper water they are gradually replaced by smaller and contracted varieties, in which the spiral portion is small and nautiloid, followed by a long series of either compressed or cylindrical joint-like cells, presenting altogether an elegant crozier-like outline. In these, as in *Dendritina*, the aperture is single and lobulate. The name *Spirolina* has been given to these attenuated varieties. Other Foraminifers, especially some varieties of *Lituolæ*, presenting similar elongate shells with a spiral commencement, have been included under the same name, thus adding to a confusion of nomenclature.

Peneroplis is characteristically a creature of warm climate, and does not exist in the North Atlantic, German Ocean, English Channel, and other north temperate seas. We fully agree with Prof. Williamson that the few specimens which he mentions and figures in his 'Monograph' are strangers to the British Fauna.

Since writing the above, we have been favoured with the valuable and beautifully elaborate memoir on *Peneroplis*, *Operculina*, &c., by Dr. Carpenter (Phil. Transact. 1859), and must refer our readers to that as a source of correct and detailed information respecting the forms under notice, the structure and tissue of which are therein described in a masterly manner; whilst they are most elegantly and copiously illustrated by some of George West's best lithographs.

Peneroplis planatus is well figured by Ehrenberg, both as to its shell and its sarcode, in the 'Abhandl. Akad. Berlin,' 1838 (1839), pl. 2. figs. *a–d*; and its Spiroline forms, under the name of "Coscinospira (Spirolina) Hemprichii," are also well delineated on the same plate, figs. *a*, *b*.

31. Nautilus aduncus. Page 115, pl. 23. figs. *a–e*. "Recent: Red Sea."

This elegant Foraminifer, now known by the generic name *Orbiculina*, which was instituted by Lamarck, has been of late years fully described and illustrated by Prof. Williamson (Trans. Microscop. Soc. 1st ser. vol. iii. p. 120) and by Dr. Carpenter (Phil. Trans. 1856, vol. cxlvi. p. 547, pl. 28. figs. 1–22, and pl. 29. figs. 1–3). To the latter we are indebted not only for a succinct history of this species, and for a clear exposition of its

structural characters, but also for the bold and masterly exposition of the true philosophical principles on which the zoological relations of this and other species of Foraminifera are to be studied. This ear-shaped *Orbiculina adunca* is doubtless the typical form, as compared with the further and extreme step in development by the increase and extension of the peripheral chambers, which produces suborbicular discoidal shells, bringing *Orbiculina* into close parallelism with the typically cyclical *Orbitolites*. The cyclical forms of *Orbiculina* may be often the result of continued growth of individuals under favourable circumstances; but frequently small starved forms quickly take on the cyclical condition, leaving the young sublenticular stage without passing through the aduncal. Therefore, in a sense, these may be regarded as varieties.

Ehrenberg has given good figures of *Orb. adunca* in Abhand. Akad. Berlin, 1838 (1839), pl. 3. figs. 1*a*–1*d*.

32. Nautilus Orbiculus. Page 112, pl. 21. figs. *a*–*d*. "Recent: Leghorn*."

This is the thick orbicular, or subnautiloid condition of *Orbiculina adunca*, which small and young specimens almost uniformly exhibit, though some are flatter. The apertural surface is as yet very contracted.

33. Nautilus angulatus. Page 113, pl. 22. figs. *a*–*e*. "Recent: Red Sea."

In this stage, *Orbiculina adunca*, still sublenticular, puts on a broader and angular septal face, showing an increase in the space for pseudopodial apertures, which will extend along the marginal area, in the adult shell, for three-fourths of a circle, and around the entire periphery in the cyclical varieties.

The neat and uniform subdivision of the chambers in *Orbiculina* is shown in the three sections given by Fichtel and Moll. We may remark that, not unfrequently, feebly-developed Peneropliform varieties, as well as good-sized Adunciform specimens, occur in which the long narrow chambers are at times simple and undivided, being occupied by transversely elongate lobes of sarcode, instead of numerous minute subcubical blocks.

Orbiculina has its home, as it were, in the West Indies; it occurs also in the Red Sea, the Indian Ocean, and on many coasts of the warmer seas.

34. Nautilus Melo. Two varieties. Page 118. "Fossil: Brunn in Austria, Kroisbach in Hungary, and other places in Austria and Transylvania."

Var. α. pl. 24. figs. *a*–*f*. Var. β. pl. 24. figs. *g*, *h*.

* This locality appears strange to us, as we have not, after much seeking, found this shell living in the Mediterranean. Dr. Carpenter, however, quotes it from the Ægean Sea; it occurs fossil in a white limestone at Corfu; and D'Orbigny figures a minute form (*O. Rotella*) from the Vienna Tertiaries.

This is an *Alveolina*, an opake-shelled Foraminifer, which, in its close relation to *Orbiculina* or *Orbitolites*, may be said to represent a small thick *Orbiculina* drawn out transversely at its umbilici, and thus bears the same relation to its congeners that *Fusulina* does to *Nonionina*.

Dr. Carpenter (*op. cit.* p. 552, pl. 28. figs. 23, 24, and pl. 29. figs. 4–9) has so well described the structure of a recent *Alveolina* illustrative of the species to which var. α (prolate spheroid) must be referred as a melon-shaped, and var. β (oblate spheroid) as a spheroidal variety, that we need merely refer to his memoir, where a historical account of the species is also given. The oldest specific name on record for *Alveolina* is *A. Melo*, which may well pass as the type. *A. Boscii* is a well-developed form, and *A. Quoyii* is a fine elongate variety, rather clubbed at the ends, which attains a large size ($\frac{2}{3}$ inch in length) in Fiji, and is also large in Australia, where, with it, *Orbitolites* arrives at its greatest development,—a similar association to that obtaining in the Eocene deposit of Grignon. In India, Egypt, Austria, Spain, and elsewhere, *Alveolinæ* occur fossil of many sizes, and of various shapes, from that of a shot to a spindle, or from that of a melon to a cucumber. They abound in rocks of the Nummulitic period. The largest we have seen was collected in Persia by the late Mr. W. K. Loftus, and is 3 inches long, and $1\frac{1}{2}$ inch in diameter!

Fichtel and Moll's 'Testacea Microscopica.'			Specific and Varietal Names, after Fichtel and Moll.	Numbers of Reference.
Page.	Plate.	Fig.		
10	1	*a–c*	Argonauta Cornu *.	
31	1	*a–c*	Nonionina pompilioides	3
33	..	*d–i*	Cristellaria Vortex	18
35	3	*a–d*	Rotalia repanda	25
37	..	*e–h*	Nonionina asterizans	1
38	4	*a–c*	Nonionina incrassata	2
40	..	*d–f*	Polystomella crispa, *Linn.*	10
47	..	*g–i*	Cristellaria costata	19
40	5	*a, b*	Polystomella crispa, *Linn.* (Sections)	10
49	..	*c–e*	Polystomella strigillata, α	9
..	..	*f, g*	—— —— β	9
51	..	*h–k*	Polystomella craticulata	11
53	6	*a–d*	Nummulina Mamilla	14
55	..	*e–h*	Nummulina lenticularis, α	15
..	7	*a, b*	—— —— β	15
..	..	*c–f*	—— —— γ	15
..	..	*g*	—— —— δ	15
..	..	*h*	—— —— ε	15

* This is the *Lippistes Cornu* of Montfort, and probably the *Separatista Grayi* of Adams.

Table—*continued.*

Fichtel and Moll's 'Testacea Microscopica.'			Specific and Varietal Names, after Fichtel and Moll.	Numbers of Reference.
Page.	Plate.	Fig.		
58	8	*a–d*	Nummulina radiata	12
59	..	*e–h*	Nummulina venosa	13
61	9	*a–c*	Polystomella striatopunctata	6
62	..	*d–f*	Polystomella ambigua	7
64	..	*g–i*	Planorbulina farcta	28
65	10	*a–d*	Rotalia sinuata	26
66	..	*e–g*	Polystomella macella, α	8
..	..	*h–k*	—— —— β	8
69	11	*a–c*	Cristellaria Calcar, *Linn.* α	16
..	..	*d–f*	—— —— β	16
..	..	*g, h*	—— —— γ	16
..	..	*i, k*	—— —— δ	16
..	12	*a–c*	—— —— ϵ	16
..	..	*d–f*	—— —— ζ	16
..	..	*g, h*	—— —— η	16
..	..	*i, k*	—— —— θ	16
..	13	*a, b*	—— —— ι	16
..	..	*c, d*	—— —— κ	16
..	..	*e, f, g*	—— —— λ	16
..	..	*h, i*	—— —— μ	16
..	..	*k, l*	—— —— Sections .	16
82	14	*a–c*	Cristellaria papillosa......................	17
84	..	*d–f*	Calcarina Spengleri, *Gm.*, α	24
..	..	*g–i*	—— —— β	24
..	15	*a–c*	—— —— γ	24
..	..	*d–f*	—— —— δ	24
..	..	*g, h*	—— —— ϵ	24
..	..	*i, k*	—— —— Sections	24
91	16	*a–c*	Peneroplis planatus, α	30
..	..	*d–f*	—— —— β	30
..	..	*g, h*	—— —— γ	30
..	..	*i*	—— —— Section	30
95	17	*a–d*	Cristellaria Cassis, α	22
..	..	*e–g*	—— —— β	22
..	..	*h, i*	—— —— γ	22
..	..	*k, l*	—— —— δ	22
..	18	*a–c*	—— —— ϵ	22
100	..	*d–f*	Cristellaria Galea	23
102	..	*g–i*	Cristellaria acutauricularis	20
103	19	*a–c*	Nonionina Faba	5
105	..	*d–f*	Nonionina Scapha	4
107	..	*g–i*	Cristellaria Crepidula	21
108	20	*a–c*	Rotalia Auricula, α	27
..	..	*d–f*	—— —— β	27
111	..	*g–k*	Planorbulina tuberosa	29
112	21	*a–d*	Orbiculina Orbiculus	32
113	22	*a–e*	Orbiculina angulata......................	33
115	23	*a–e*	Orbiculina adunca	31
118	24	*a–f*	Alveolina Melo, α	34
..	..	*g, h*	—— —— β	34

XXI.—*Descriptions of Desmidiaceæ from Lower Bengal.*

By G. C. Wallich, M.D., F.L.S.

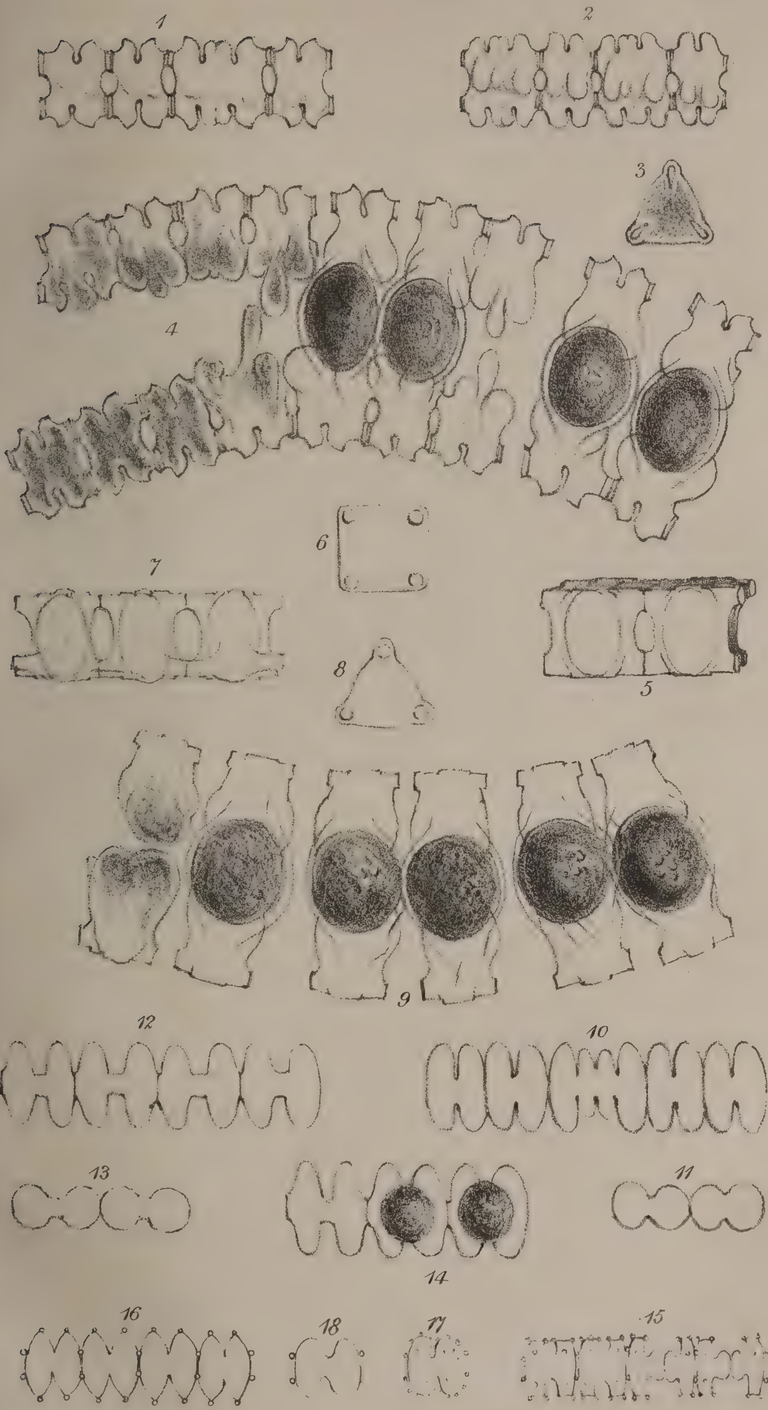
[With two Plates.]

The Desmidiaceæ which form the subject of the present and following communications were obtained during the latter months of 1855, in the neighbourhood of Raneegunge, at that period occupied as a small military outpost, about 120 miles to the north-westward of Calcutta.

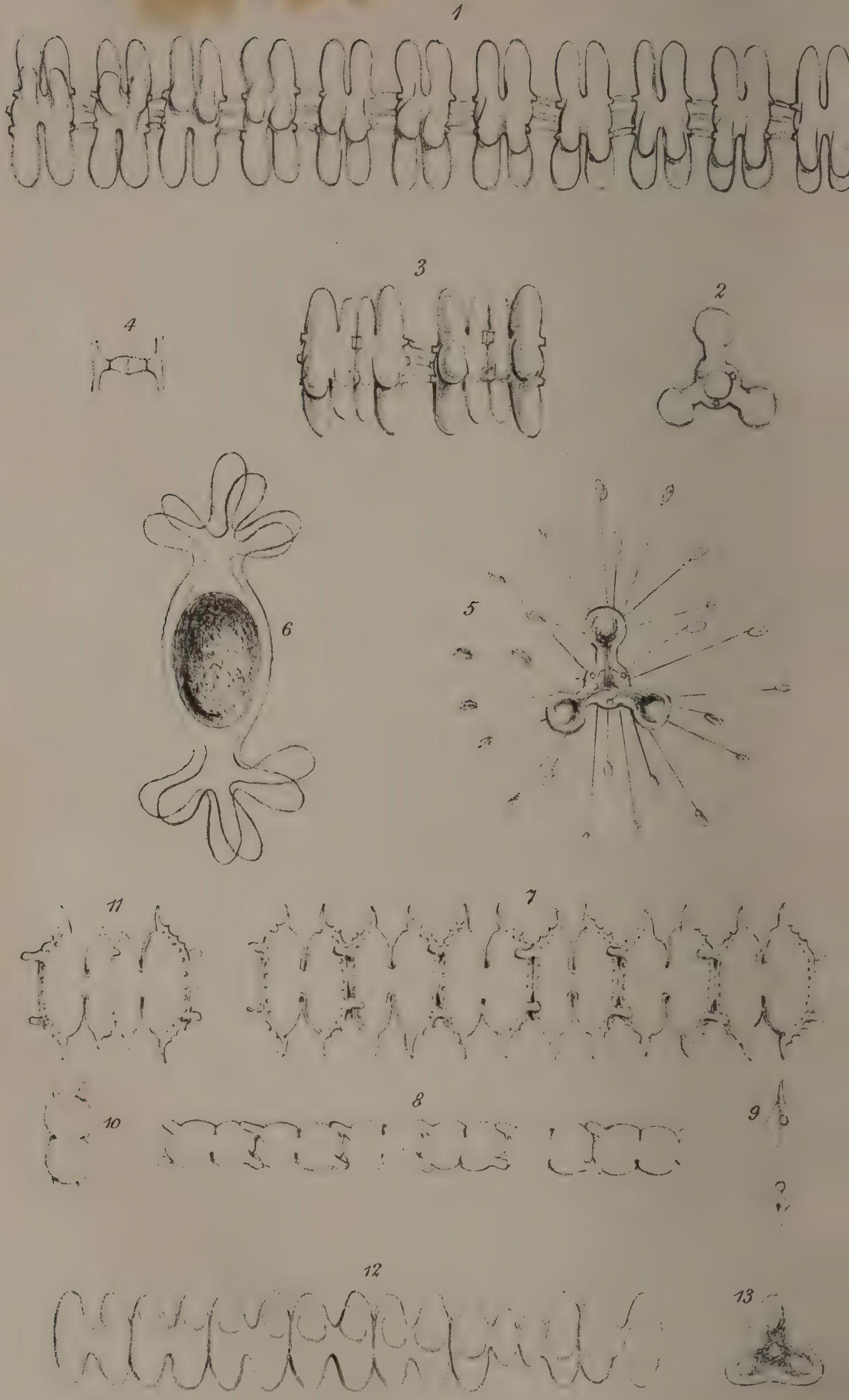
Nearly one hundred and forty distinct species (representing the whole of the British genera, with one exception, namely *Didymoprium*), or rather more than two-thirds of the entire number of British species, were collected by me, in this short space of time, within an area not exceeding 100 square miles in extent. This fact is worthy of record, inasmuch as it renders it highly probable that a very important addition to our knowledge of this class of organisms would result from a careful exploration of the adjoining districts, and more especially of the vast tract of alluvial territory which, commencing near this point, stretches away towards the sea, and presents all the characters preeminently adapting it for the habitation of the whole tribe of freshwater Algæ.

As might be supposed from the cosmopolite nature of the Desmidiaceæ generally, a large proportion of the species referred to are identical with those already known to occur in Europe and America. Many, however, are new; and these certainly equal, if they do not actually surpass, any of the hitherto recorded forms in beauty and symmetry. Amongst the more common species a remarkable amount of "divergence" from the typical character is everywhere to be met with,—a circumstance depending, no doubt, on those peculiarities of soil and climate which, in Lower Bengal, are so favourable to the exuberant and rapid development of the entire vegetable kingdom. Such peculiarities operate, however, on the more minute tribes in a special degree; for whilst the higher orders of plants are subject only to the regularly recurring changes of a tropical region, and undergo no abrupt or violent transitions as regards habitat, the humbler Algæ are borne abroad, during their sporangial state, to great distances and into positions differing widely in nature from those wherein they were originally engendered. The liability to variation arising from this cause must necessarily be extreme; and, therefore, few situations could be found in which the limits attainable by specific divergence, as occurring in these organisms, could more easily and satisfactorily be determined.

It is almost impossible to arrive at a correct estimate of the



Drawn on Stone by G.C.W.



Drawn on Stone by G.C.W.

outburst of fresh life to which microscopic forms are subject in such a climate, by any comparison with what is observable elsewhere. Immediately prior to the setting in of the annual rains, the swamps, pools, water-courses, and even the majestic rivers, are well nigh dried up. The surface of the soil is parched into a layer of impalpable dust, and the remnants of all the minute tribes of plants are carried to and fro, by the slightest winds, amongst the dusty particles to which they themselves largely contribute. At this period the sporangial state is assumed both by the Desmidiaceæ and Diatomaceæ, and it may be regarded, therefore, as a species of hybernation, during which vitality is maintained under the minimum of the conditions essential to its continuance, and without the interposition of which phase these organisms would become extinct. For upwards of two months the rains continue to fall incessantly. The whole country is flooded, and the rivers expand to the proportions of inland seas. It is useless, as yet, to search for the Desmidiaceæ. No sooner, however, have the rains and inundations subsided, than the mud-laden pools clear down, the magic influences of light and heat are permitted to operate, and, in an incredibly brief period, the surface, the bottom, and the body of the waters absolutely teem with the crowded masses of animal and vegetable life.

In endeavouring to classify the various forms, I have very reluctantly been compelled, in several instances, to modify the arrangement laid down in Mr. Ralf's admirable Monograph of the Desmidiaceæ. I would mention, however, that there are two or three characters adopted by that author which, as far as my observation of the Bengal forms is concerned, are of too variable a nature to be admissible for purposes of diagnosis. Thus, according to the varying periods of growth of the organism, the endochrome may be equably disposed in minute granules throughout the protoplasmic cell-contents, it may be aggregated into definitely or indefinitely shaped masses, or it may present itself in the form of radiating bands, generally answering in number to the number of lobes or angles of the given species, and offering cleft or entire extremities according as the granules have remained dispersed or have coalesced under the molecular law to which they are subject. In some genera the disposition of the endochrome must, no doubt, be regarded as highly characteristic,—as, for instance, in *Docidium*, *Penium*, *Tetmemorus*, and *Closterium*. But even in different individuals of each of these genera, and in the same individual under different conditions, it will be found to vary greatly; and for this reason I have deemed it advisable, as a general rule, to confine my illus-

trations merely to outline, every diagnostic purpose being thereby answered, a more definite and clear expression of form being conveyed to the eye, and last, but perhaps not least, a very great deal of useless labour being avoided.

In like manner, I have refrained from denoting the number of joints engaged in forming one of the dark diagonal bands ranging from angle to angle, as observed in some of the filamentous genera, owing to its variable character. Indeed I doubt whether, in the normal state of these forms—that is, during their unrestrained growth in their native element—the twisting to which this appearance is due exists at all. In perfectly still water, it is probable that no twisting occurs; and in corroboration of this view, I may mention having repeatedly examined filaments under a low power and without compression of any kind, in which no torsion, or but a slight amount of it, was manifest, whilst, under pressure between the glass slide and cover, the same species has exhibited it in a very marked degree. It is probable that, in many cases, the torsion of the filament is engendered under the manipulation of the observer; and it is certain, at all events, that by modifying the amount of compression employed, the amount of torsion, and, with it, the number of joints engaged in a complete convolution of the filament, may be materially influenced.

Synopsis of the Filamentous Genera.

Sporangia orbicular, or oblong, plane.

1. Hyalotheca. Filament cylindrical.
2. Desmidium. Filament compressed, triangular or quadrangular. Joints deeply constricted. Connected together by minute projecting cushions at the outer portion of each lobe or extremity.
3. Aptogonum. Filament triangular or quadrangular. Constriction entirely absent. Margins plane or very faintly crenated.
4. Sphærozosma. Filaments compressed. Margins incised, sinuate or angular. Joints constricted. United together by minute lateral tubercles.
5. Leuronema (n. g.). Filament compressed, plane. Margins incised or sinuate. Joints constricted. Without intermediate processes.
6. Onychonema (n. g.). Filament compressed. Margins serrate. Joints deeply constricted and united together by overlapping cornua.
7. Streptonema (n. g.). Filament triangular, interrupted. Joints deeply constricted. Segments 3-lobed. Joints united by cylindrical filaments given off from the base of each lobe.

1. *Hyalotheca*, Ehr.

Filament cylindrical. Joints having either a slight central constriction or a double rim at one or both extremities. End view circular.

1. *H. dissiliens*, Ralfs. Filament very slightly constricted at the centre of each joint.

Frequent. Length of joint from ·0003″ to ·0008″; breadth of joint ·0003″ to ·0012″.

2. *H. mucosa.* var. *β*. Joints not constricted, but having a double rim at both their extremities.

Length ·0007″; breadth ·0004″.

This variety differs from the form described and figured by Mr. Ralfs ('The British Desmidieæ,' p. 53, tab. 1) in having the double rim at each extremity of the joints, instead of only at one of these. Moreover, these rims, on careful illumination, are found to consist of rows of minute elevated puncta.

Both *H. dissiliens* and the last-named variety of *H. mucosa* occur abundantly, intermixed with the larger Algæ and with *Anacharis alsinastrum**, during the height of the rainy season, in the turbid and swollen water-courses. In this respect they differ from the great mass of the Desmidiaceæ.

2. *Desmidium*, Ag.

Filament compressed, triangular, or quadrangular. Joints constricted deeply. United by minute, projecting, mucous cushions, which spring from the outer portion of each lobe or extremity.

It will be observed that the above definition is framed with a view to include the plane and triangular varieties of *Aptogonum Desmidium*, which differs in no material point from the genus now under notice, as will presently be seen. But whilst I concur with Brébisson, Meneghini, and Kützing in uniting the species referred to under *Desmidium*, I would submit that the peculiarly marked character exhibited by *Aptogonum Baileyi* and a new variety obtained from Lower Bengal—namely, the entire absence of constriction on the joints, which accordingly are not divided into segments—is of sufficient importance to demand their separation.

* It is worthy of notice that this curious plant, which is generally understood to have been introduced into Britain from North America, may with equal probability have been introduced from Bengal along with the "Jute" fibre (*Corchorus capsularis*, a staple article of export to this country), which is subjected during preparation to long-continued maceration in the streams and pools.

The characters of the two genera, as given by Ralfs, are as follows:—

"*Desmidium*: *filament* fragile, elongated, triangular or quadrangular, regularly twisted; *joints* bidentate at the angles.

"*Aptogonum*: *filament* elongated, triangular or plane; *joints* bicrenate at the margins; an oval foramen between the joints."

And again: "Certainly the state with triangular filaments does at first sight appear closely allied to *Desmidium Swartzii*; but the large oval foramen between the joints is so remarkable a character, that I must concur with Ehrenberg in placing it in a separate genus*."

Now in the Bengal forms the "foramina" are to be met with indiscriminately in all the species and varieties; that is, in the genus described by Ralfs as *Desmidium*, and also in that which must be referred to *Aptogonum*. The generic character founded on this structure must therefore fall to the ground.

In *Aptogonum Desmidium*, as figured (*loc. cit.*), as well as in all the British specimens that have come under my notice, the whole physiognomy of the plant tallies so exactly with the characters of *Desmidium*, and the presence of a constriction is so distinct as, in my humble judgment, to leave no room for doubt. On the other hand, no two forms can appear more dissimilar in general outline than the species just referred to and that recorded as *Aptogonum Baileyi*. For not only is all semblance of constriction wanting, but the margins are so direct and so nearly plane as to strike the eye at the first glance. The figure of the American species, as given by Mr. Ralfs from a drawing by Professor Bailey, presents no trace of marginal crenature, and in this feature fails to conform to the generic character assigned to it. But, from its unmistakeable identity with the triangular form from Bengal, and likewise from what is to be observed in the quadrangular variety from the same locality, I cannot help thinking that the faint marginal irregularity does in reality exist. In the Bengal forms it depends on a large oblong portion of each free face of the joints being very slightly raised above the surrounding surface. As seen, therefore, in different positions of the joint, these flattened elevations appear broader or narrower according as the ends or broader portion of the oblong strike upon the outline.

On careful examination, it will be found that the spaces alluded to under the name of "foramina" are to be met with in all the filamentous forms the joints of which are united together by intervening projecting cushions or processes placed at their

* 'The British Desmidieæ,' Ralfs, pp. 60, 63 & 208, tab. 4, 5, & 32.

angles, or not precisely at their central portions; whereas in such forms as are united side by side, without the interposition of these bodies, by their centres, these spaces do not, and indeed cannot occur. Amongst the filamentous Diatomaceæ, as for instance in *Triceratium*, *Biddulphia*, *Hydrosera*, and others, similar spaces are to be found,—the cornua in these organisms (which are the analogues of the projecting angles of the Desmidiaceæ under notice) being only more largely developed.

In Bengal occurs a variety of *D. Swartzii* in which the angles are not "bidentate," but rounded and plane. This may possibly be identical with the variety noticed as "*D. Brébissonii*, var. α" in Kützing's 'Species Alg.' p. 190. The characters there given are "articulorum dentibus truncatis; interaneis sex-radiatis, radiis geminatim conniventibus apice non incrassatis."

This form is quite as abundant as that with the bidentate angles; but, from the manner in which the lobes present every gradation between those that are quite plain and rounded and such as have the most strongly marked dentations, it seems highly probable that the one variety is but a young state of the other, all the other characters remaining identical. The generic character derived from these processes has accordingly been omitted.

1. *D. Swartzii.* Filament triangular; joints bidentate at the angles, deeply incised. End view triangular. Uniting cushions cuneiform.

In the front view the joints are quadrangular, and somewhat broader than long. A deep constriction divides the joint into two segments, which have an angular tooth at their margins. In the end view the connecting cushions are cuneiform, their apices being directed towards the centre of the joint. The space left between the joints varies greatly at different periods of growth, and in different specimens. In the front view of the filament, the connecting cushions present minute angular projections at the points of union with each other; and lastly, in the end view the joints are finely granular.

With reference to the sporangial condition of this species, Mr. Ralfs remarks: "I have gathered at Dolgelly some fragments of this plant which had the endochrome condensed into a sporangium-looking body in the centre of each joint. As in every other species of this family in which the reproductive body has been detected it is the result of the coupling of the cells, I think it best merely to direct attention to the fact I have mentioned, leaving its nature to be determined by future observation." (Ralfs, 'British Desmidieæ,' p. 62, tab. 4.)

In the same work (Appendix: "List of Species not hitherto detected in Britain," p. 208, tab. 35. fig. 1) the following passage

occurs with reference to the sporangial condition of *Aptogonum Baileyi*: "Professor Bailey has sent me a drawing of the conjugated state, very interesting from its resemblance to a condition of *Desmidium Swartzii*, which I had doubtfully regarded as the sporangia of that species. In both plants it is difficult to understand the process or to distinguish the coupled filaments, since the appearance is merely that of a much enlarged and torn filament."

It was my good fortune to meet with the sporangial condition of both forms in considerable abundance, and thus to detect the true mode in which the sporangial filament is produced. The appearance of the mature sporangial filament is precisely similar to that figured by Mr. Ralfs (tab. 4), and tallies with the general description given in the paragraph last quoted. But during the process of formation it has been found by me to be the joint produce of *two* ordinary filaments. By what mysterious vital tendency these ordinary filaments are drawn together, we shall probably never learn. But that something more is necessary than the mere accidental coming in contact of two filaments is at once evident from the fact that, were nothing more needed, filaments would be found at times held together, by a single pair of conjugated cells, at right angles or inclined towards each other. This is never the case. The filaments engaged are invariably placed parallel to each other, and although cells here and there appear to be abortive, the entire number for which there are pairs gradually become fused together. When a few cells have united by this process, the remainder are possibly placed in the most favourable position to take their share in it; but even this leaves much to be accounted for,—and more especially the projection of the elongated sac-like vesicles in a direct line towards each other, whilst a portion of each filament remains separated from its fellow by a considerable interval.

The process takes place in the following order. From the base of one of the constrictions a minute sac is protruded. As it extends in size, the adjacent lobes are pushed widely asunder, the proximate angles become turgid, and the endochrome, which has become condensed at this point, is gradually poured into the sac. The already conjugated cells are kept asunder by their enclosed sporangia, at a distance nearly equal to the diameter of the filament. The elongated sacs at first simply impinge upon each other. Shortly, however, they become incorporated, the interposed portion of double cell-wall is absorbed, the contents of the opposed joints coalesce, and form the large oblong or circular sporangial bodies which we find occupying the enlarged common cavities between the two conjugated filaments. Lastly, the sporangia remain for a time encysted as just described; but

eventually the common cell-wall becomes either broken up or absorbed, the sporangium is invested with its own proper tunics, and, separating entirely from the parent filaments, it wanders forth on its own peculiar reproductive mission.

We find in this process a remarkable coincidence with what is observed to take place in the conjugation of the Zygnemaceæ, as, for instance, in *Tyndaridea*, *Mesocarpus*, and *Staurocarpus*; and another argument is thus afforded, if indeed any be necessary, to prove the close affinity of the class of organisms under notice with the Confervoid Algæ in general.

Length of joint ·0006″; breadth ·0014″.

Lower Bengal, 1855.

Plate VII. fig. 1. A portion of a filament of *D. Swartzii*. Fig. 2. A similar portion of var. β, with rounded angles. Fig. 3. End view, showing cuneiform processes. Fig. 4. Sporangial filament in process of formation.

3. *Aptogonum*, Ralfs.

Filament triangular or quadrangular. Constriction entirely absent. Margins plane or very slightly crenated.

The intermediate spaces, in both the Bengal forms of this genus, are subject to considerable variation in size. The prominent character on which I ground the necessity for retaining them in a distinct genus has no reference, however, to this character, on which Mr. Ralfs lays such emphasis, but to the *entire* character of the joints, and the total absence of the constriction which produces it, and at the same time offers a marked distinctive feature between this genus and the rest of the filamentous plane or angular Desmidiaceæ, without exception*. Two forms occur in Lower Bengal: one, the triangular typical species, *A. Baileyi* of Mr. Ralfs and Prof. Bailey; the other a quadrangular variety, which I have nevertheless referred to the same species, as daily experience in this and the allied family of the Diatomaceæ clearly proves how liable these humble organisms are to variations of such a nature, when placed under varying conditions of growth, or derived from different localities, which is much the same thing.

1. *A. Baileyi.* Filaments linear; joints, in front view, quadrangular, nearly equal in length and breadth. Uniting cushions circular. End view triangular.

It has already been mentioned that the margins are faintly irregular, a large oblong portion of the free sides of each joint being slightly raised above the surrounding surface, and thus

* In empty joints, the junction of the segments is indicated merely by a faint transverse line, as in *Closterium*. This line is omitted in the figures.

detracting somewhat from the otherwise straight character of the margins.

Lower Bengal, 1855.

Length of joint ·0008″; breadth ·0009″.

Plate VII. fig. 7. Portion of a filament. Fig. 8. End view of same. Fig. 9. Sporangial state of same.

A. Baileyi, var. *quadrangulatum*. Filament linear. Joints in front and end view quadrangular. Uniting cushions circular.

Lower Bengal, 1855.

Length of joints from ·0008″ to ·0012″; breadth the same.

Plate VII. fig. 5. Front view of portion of filament. Fig. 6. End view of same.

4. *Sphærozosma*, Corda.

Filament compressed. Margins incised, sinuate, or angular. Joints constricted, and united to each other by minute tubercles.

I have found it necessary to modify the definition of this genus as given by Mr. Ralfs, in order to admit the several varieties which cannot be termed "plane." None of the filamentous forms of Lower Bengal exhibit greater diversity of outline and size. So great, indeed, is this diversity in some specimens, that, were it not for the gradual transition recognizable from one to the other, we should have to elevate them into distinct species. As it is, I consider the constant aspect and position of the connecting tubercles in the three varieties of *S. excavatum* figured by me a sufficient ground for accepting them as varieties only. The deviations from the typical form of *S. vertebratum*, which occur with the former species abundantly, although great as regards size, are not otherwise of sufficient consequence to demand notice in this place.

S. excavatum. Joints constricted. Lobes rounded, abruptly truncate or angular at their extremities, with two sessile tubercles on each margin at their junction with each other.

In the three varieties, the tubercles are situated about a third of the length of the lobes apart.

Var. β. Lobes abruptly truncate, their truncate surfaces flattened, with a minute tubercle at each angle, and four or more tubercles on each front view of the joints. (Pl. VII. fig. 15.)

Var. γ. Lobes broadly lanceolate, constriction angular; extremities acute, with one tubercle at their apices. (Pl. VII. fig. 16.)

Var. δ. Outline as in typical *S. excavatum*, but with numerous tubercles arranged irregularly *over the surface* of the joints. (Pl. VII. fig. 17.)

Plate VII. fig. 15. Portion of filament of *Sphærozosma excavatum*, var. β, front view. Fig. 16. Ditto of ditto, var. γ, front view. Fig. 17. Single joint of ditto, var. δ, front view. Fig. 18. Single joint of ditto, ditto. Typical form.

5. *Leuronema*, n. g.

Filament compressed or triangular. Margins incised or sinuate. Joints deeply constricted. Without intermediate processes.

The absence of intermediate processes of any kind whatsoever renders it necessary to separate the following forms from *Sphærozosma*, in which genus the connecting tubercles constitute a primary character. Three varieties occur abundantly in some gatherings, but neither of these exhibits the slightest trace of intermediate processes under any circumstances. The joints seem merely to be pressed together, edge to edge, and to be retained in position by the general mucous envelope common, in greater or less degree, to *all* the filamentous Desmidiaceæ of Lower Bengal, and to the majority of the non-filamentous forms. It can scarcely be doubted that this envelope is universal, although less easily seen in a few species.

The filaments are of great length, notwithstanding the absence of any special uniting processes, and do not break up more readily into single joints than their allied forms. A single joint of the compressed species, when separate, might readily be mistaken for a small *Cosmarium*; whilst one of the triangular variety might in like manner be looked upon as a *Staurastrum*. But the strictly filamentous character shared by both serves at once to distinguish them from both of these genera.

I have numerous specimens of the compressed species which exhibit spherical sporangium-like bodies, attached at one point to the constricted base of the joints; but there is no evidence forthcoming to prove that these bodies are the product of conjugation of pairs of joints from different filaments, as is the case in the sporangial state of the species already described by me. They may be perfect sporangia, however, if we conceive the second series of conjugated joints to have separated, or to have broken up, on the completion of their functions. However this may be, the cysts containing the bodies in question spring from precisely the same point as in the other forms noted—namely, from the base of the constriction; and it is therefore difficult to consider them in any other light than as sporangia. If admitted to be such, their smooth, plane cell-wall affords a strong additional ground of distinction from *Cosmarium* and *Staurastrum* respectively.

1. *L. nitens*, n. s. Filament pinnatifid. Joints compressed, deeply constricted. Extremities of joints rounded.

The connecting surfaces of the joints in this form are quite plane, and the segments are closely approximated. Joints

somewhat broader than long. Marginal view of joints dumb-bell-shaped, but without any isthmus.

Length of joint ·0006″ to ·0008″; breadth of ditto ·0008″ to ·0012″.

Plate VII. fig. 10. Front view of a portion of filament. Fig. 11. Marginal view of two joints.

Var. β. This differs from the above in having the segments of the joints separated by a well-defined isthmus. The intermediate notch is accordingly somewhat gaping. So long as in filament, the connected surfaces of the joints are slightly inflated; but this character is transitory, inasmuch as the outer segment of a filament is often found to be entirely free from it.

It will be observed that the difference between the two forms just described is hardly more than one of degree; that is, no structural distinction exists. It is probable, therefore, that they may merge one into the other at certain periods of their growth. I may state, however, that the transition, in any one filament, has not been met with by me.

Length of joint ·0008″ to ·0010″; breadth of ditto ·0007″ to ·0012″.

Both from Lower Bengal, 1855.

Plate VII. fig. 12. Front view of a portion of a filament. Fig. 13. Marginal view of two joints, showing the perfect dumb-bell shape, due to the presence of the isthmus. Fig. 14. Two of the sporangium-like bodies attached to the filament.

Var. γ. Filament triangular; its margins sinuate. Joints deeply constricted. Segments 3-lobed. End view triangular.

This remarkable variety might be regarded as a filamentous *Staurastrum*. But the same reason that serves to distinguish the compressed form from *Cosmarium* must distinguish this one from the genus it so closely resembles.

I may add that if, by any possibility, the first varieties of this genus could have been merged into *Sphærozosma*, the occurrence of the last-described variety must at once have rendered the junction impossible, except by placing it in a genus by itself, against which course the reasons are equally obvious.

Length of joint ·0008″ to ·0010″; breadth of ditto ·0008″ to ·0012″.

Lower Bengal, 1855.

Plate VIII. fig. 12. Front view of a portion of a filament. Fig. 13. End view of a joint.

6. *Onychonema*, n. g.

Filament compressed. Margins inciso-serrate. Joints deeply constricted, and united to each other by diverging subcapitate cornua.

The remarkable form of the overlapping and alternating

cornua, and the uncinate processes given off from the extremities of the segments, at once distinguish this genus from all others.

1. *O. uncinatum*, n. s. Joints quadrangular in front view, deeply constricted. Segments furnished with two obliquely placed cornua on their outer surfaces, and with a recurved claw at each of their extremities.

The joints in this form are somewhat more turgid than in *Sphærozosma* or *Leuronema*. The constriction is so deep as to leave little more than a third of the entire breadth of the joint as a connecting isthmus. The segments are closely approximate. The cornua are situated obliquely to each other, at the outer thirds of the lateral surfaces; they are cylindrical, half as long as the segments are broad, and slightly capitate. Between the cornua and the claw-like processes a row of minute teeth presents itself, whilst the median line of the segments, on their outer aspects, is bordered by two rows of minute puncta. These are, however, rarely visible, except in such joints as happen to be empty. The whole of the cornua (as seen in the front view) placed on the same side of the median line and same extremity of the segments, overlap the adjoining joint in the same direction. The two sets of cornua, therefore, as seen in this view, face in opposite directions, the upper in one, the lower in another. These cornua are not mere tubercular solid excrescences, as in *Sphærozosma*, but are formed by an extension of the cell-walls, like the fingers of a glove, and are accordingly hollow for a certain distance, the tenacity of the filament being so far increased by their instrumentality that it is constantly seen to divide rather at the segments than at the joints.

In the young state, the uncinate processes are sometimes imperfectly developed, and might induce the belief that the form exhibiting them in this state was a variety.

The marginal view is linear, and faintly sinuate or incised, from the outline of the cornua being observable, and the constriction, which in this aspect is just discernible. In the end view, the alternating and divergent character of the cornua is very remarkable. This last feature affords a close point of resemblance, it may be observed, to the structure and apparent function of the obliquely arranged spines and cornua in some species of the genus *Biddulphia*.

Length of joint ·0008″ to ·0012″; breadth of ditto ·0012″ ·0020″.

Lower Bengal, 1855.

Plate VIII. fig. 7. Front view of a portion of a filament. Fig. 8. Marginal view of filament. Fig. 9. Transverse view. Fig. 10. End view. Fig. 11. A joint undergoing division.

7. *Streptonema*, n. g.

Filament interrupted. Triangular, deeply pinnatifid. Joints deeply constricted, and united to each other by three cylindrical hyaline bands given off from the base of each lobe. Segments deeply 3-lobed.

1. *S. trilobatum*, n. s. Joints very deeply constricted, furnished on their outer surfaces with three stout connecting bands, which unite with those from the adjacent joints. Segments 3-lobed; bases of lobes parallel with the base of constriction.

This genus is allied to *Sphærozosma*; but the structure of the connecting processes is so unique as to leave no doubt of its distinct character. Seen in the front view, under the microscope, the filament looks somewhat less symmetrical in the disposition of its details than is usual in the beautiful class of organisms to which it belongs; but this want of perfect symmetry is due to causes that do not affect it in its normal condition. Thus seen, the lobes are distorted to some extent, and the connecting bands, in like manner, appear less direct than they ought to do. This form is nevertheless peculiarly elegant.

The constricted portion of the joints presents a short isthmus. The segments are accordingly not very closely approximated. Each lobe is inflated towards its free extremity. In the end view the joints are triradiate; the central isthmus appearing as a circular cavity, from the margin of which the lobes arise at equal distances, and the tubercular bases of the connecting bands being placed midway between them.

The connecting processes or bands are marked by three transverse lines, at the central one of which the bands are somewhat thickened. When the filament breaks up, the bands disunite at either of these lines; and, at first sight, it would appear as if each band were formed by the interposition of two short cylinders attached to the projecting tubercles situated, as already described, at the base of each lobe.

Whilst the joints are undergoing division, the young segments are closely pressed together, and the rudiments of the connecting bands are to be seen in the form of minute flattened processes, which gradually extend outwards as the two new joints become perfect and separate, and ultimately constitute the connecting bands.

The sporangium is formed by the conjugation of the joints of two distinct filaments, as described in *Desmidium* and *Aptogonum*, —a sac-like vesicle being protruded from the base of the opposed joints, these vesicles by degrees coalescing to form a cell, into which the endochrome is collected. Before the sporangial mass is quite mature, the filament breaks up; but several of the spo-

rangial sacs, with their parent-joints still attached, are constantly to be met with, placed side by side, and probably retained near each other by a common mucous envelope. The cells at this period are elliptical, their ends being produced somewhat, and coalescing with the now empty joints. At maturity, the old joints are cast off entirely, the cell closes, assumes a perfectly elliptical outline, and the sporangium presents itself in a guise similar to the mature detached sporangia seen in some of the Zygnemaceæ.

The mucous matrix in which the species of this genus are imbedded often exhibits a number of pin-like bodies, stuck, as it were, into every part of the joint,—the heads, which are minute, oblong, granular, and of a rich green colour, being directed outwards. These growths appear to be epiphytical, and are seen also in the various forms of *Sphærozosma* and *Leuronema*. Their minute size renders any examination of their characters impossible. It may be mentioned, however, that they are quite distinct in aspect from the delicate radiating lines frequently met with in the mucous envelope of the majority of the Desmidiaceæ.

Length of joints ·0008″ to ·0009″; breadth of ditto ·0012″ to ·0019″. Length of connecting bands ·0002″ to ·0004″.

Lower Bengal, 1855.

Plate VIII. fig. 1. Portion of a filament seen in front view. Fig. 2. End view of a single joint. Fig. 3. Two joints undergoing division. Fig. 4, exhibiting the appearance of a single connecting band. Fig. 5. End view of a joint, showing the pin-like epiphytic growths. Fig. 6. A sporangium just prior to the casting-off of the empty parent-joints.

[All the figures, with the exception of Fig. 4. Pl. VIII., are magnified 400 diameters.]

[To be continued.]

XXII.—*Remarks on* Mr. M‘Andrew's "*Note on the Comparative Size of Marine Mollusca in various Latitudes of the European Seas.*" By John Gwyn Jeffreys, F.R.S.

The importance of this question in a geological point of view, and especially with regard to the history of the so-called "Glacial epoch," will, I trust, be accepted as my apology for saying a few words on the subject. Although I do not profess to have had the experience of my friend Mr. M‘Andrew in dredging in extreme northern and southern latitudes, my acquaintance with the marine Testacea of our own coasts, as well as a careful examination of the collections of Möller, Costa, D'Orbigny, Mr. M‘Andrew, and others in the British Museum, with reference to the maximum size of the specimens contained therein, compared with those in my own collection of British shells (inde-

pendently of my Mediterranean dredgings), enable me to substantiate the proposition which I ventured to enunciate in a former Number of the 'Annals' (ser. 3. vol. ii. p. 120), that, "in general, the size of specimens increases in a ratio inverse to their northern, and converse to their southern, point of latitude."

I will now consider, *seriatim*, all the instances adduced by Mr. M'Andrew, by which he seeks to disprove my proposition.

1. *Corbula nucleus.*—This species is very variable in respect of size on the British coasts; and Mr. M'Andrew may have found a small variety upon the shores of North Drontheim.

2. *Trochus lineatus.*—Specimens which I have collected in Wales and Donegal Bay considerably exceed in size Mr. M'Andrew's specimens from the north coast of Spain and Mogador.

3. *Astarte sulcata.*—Most variable in size on our own coasts, and probably also in the northern localities indicated by Mr. M'Andrew.

4. *Astarte triangularis.*—I believe I can match, in point of size, specimens from North Britain with any which Mr. M'Andrew has from Gibraltar Bay.

5. *Crenella* (Modiola) *marmorata.*—The largest specimens I ever saw were said to come from Greenland.

6. *Crenella rhombea.*—The size of some of my specimens from Guernsey is fully equal to that of Mr. M'Andrew's largest specimen from the Canaries or Mediterranean.

7. *Nucula nucleus.*—Mr. M'Andrew's specimens from Finmark appear to be a small variety, which also occurs on our own coasts.

8. *Nucula decussata.*—Mr. M'Andrew's specimens from the south of Spain are not much more than half the size of my Oban specimens.

9. *Cardium rusticum.*—Mr. M'Andrew had probably not seen the very large examples from the south of Devon when he stated that this species increased in size southward from the British Channel.

10. *Cardium papillosum.*—This has only recently been discovered to inhabit the British Isles; but a specimen in Dr. Lukis's cabinet is quite as large as any that I have seen from the Mediterranean.

11. *Cardium pygmæum.*—Mr. M'Andrew's specimens from Vigo Bay are not so large as some which the late Mr. Warren sent me from the south of Ireland; and I found specimens nearly as large as the last at Falmouth.

12. *Venus verrucosa.*—British specimens are larger than any which I have seen from more southern latitudes.

13. *Mactra stultorum.*—I suspect that the specimens mentioned by Mr. M'Andrew belong to another species, probably to the *M. inflata* of Bronn.

14. *Littorina rudis.*—This species is known to be extremely variable in respect of size. The largest I have ever seen were from the north of Ireland.

15. *Scalaria communis.*—I have never seen any Mediterranean specimens equal in size to those found in this country.

16. *Bulla hydatis.*—Does Mr. M'Andrew mean the *B. hydatis* of Linnæus, which is extremely rare in this country, but common in the Mediterranean, or *B. cornea* of Lamarck, which is our common species, though it is also found in the Mediterranean?

17. *Murex erinaceus.*—British specimens are considerably larger than those from the coasts of Spain collected by Mr. M'Andrew, and now in the British Museum.

18. *Cerithium reticulatum.*—Mr. M'Andrew probably means the large variety (*C. lima* of Bruguière), which is found in the Channel Isles as well as in the Mediterranean. Specimens of the normal form, which I obtained by dredging on the Piedmontese coast, are smaller than those of our own shores. This last is the var. β. of Philippi.

19. *Cerithium* (Triforis) *perversum.*—The same remark applies to this also.

20. *Aclis supranitida.*—Specimens collected by myself in North Wales are quite as large as those of Mr. M'Andrew from Madeira. An allied species (*A. ascaris*), which is of a much smaller size, is frequently confounded with the above, and may have been referred to by Mr. M'Andrew as the British species.

Tellina balaustina is not, as Mr. M'Andrew might lead your readers to suppose, only found on the *western* or *Atlantic* coast. It also occurs on the *eastern* coast of Zetland, and probably is as common there as in the Mediterranean; but the northern seas are, during the greater part of the year, too stormy to admit of much exploration.

Even in the case of the *Teredines*, which inhabit submerged and floating wood, and may therefore be supposed to be peculiarly subject to climatal influence, specimens of *Teredo denticulata* from Greenland, in the British Museum, are twice the size of the few specimens which have been hitherto found living on the British shores; while *T. Philippii* attains here much greater dimensions than in Sicily or more southern parts. British examples of *T. Norvagica*, *T. navalis*, and *T. pedicellata*, appear also to exceed in size those found on the north coast of Spain and in Sicily, judging from the figures given by Quatrefages and Philippi. The *Teredines* are stated by M. Laurent not to be pelagic, but confined to the coast-line, although some of the species have a very wide geographical range.

Taking the British Mollusca as the standard of comparison, I would also remark that the following species in particular appear

to attain a larger size in our own seas than in the south of Europe: viz., *Murex corallinus, Lachesis minima, Rissoa striatula, Donax politus, Avicula Tarentina, Galeomma Turtoni,* and *Trochus striatus.* These are, according to the late Professor Edward Forbes, some of the principal representatives of the "Lusitanian" type.

To these may be added species of *Artemis, Cylichna, Mactra, Mangelia, Nassa, Natica, Neæra, Pecten, Pectunculus, Syndosmya, Tapes, Tellina, Tornatella, Trochus, Turritella, Venus,* and probably of every other genus which is common to the European seas.

I have purposely omitted any of the species which Mr. M'Andrew may consider as "Arctic," "Boreal," or "Celtic," although I apprehend such geographical distinctions have no foundation in fact or in nature.

The difference between Mr. M'Andrew and myself (or the error into which one of us has fallen) may have arisen from our respective collections being better furnished with specimens of the shells which each has had greater opportunities of procuring; and it is to be hoped that further experience will show which of our conclusions is correct.

XXIII.—*On the Tribe* Colletieæ, *with some Observations on the Structure of the Seed in the Family of the* Rhamnaceæ. By John Miers, F.R.S., F.L.S. &c.

[Continued from p. 95.]

In regard to the general structure of the flower in the *Colletieæ,* there is little to add beyond what we find recorded on the subject; but it may be remarked that the lobes of the calycine border in that tribe, as in others of the *Rhamnaceæ,* have a prominent keel along the middle of their internal face, which terminates below the apex in an elevated callous gland, connected with two other raised lines that run along the border. These medial keels and glands have been supposed by some to be so many sterile stamens; but Brongniart, with more truth, considers their appearance to be the result of the impression left upon the soft fleshy lobes of the calyx, while in æstivation, by the indentation of the enclosed petals and stamens: that such is the real cause, is shown in the instance of *Gouania,* where a similar carinal prominence exists in the calycine lobes, and, in addition, at the base of each keel is seen an acute scale, which is really the rudiment of an abortive stamen. Similar impressions are frequent in many other families where the floral envelopes have a valvate æstivation. We meet with another point of structure in the *Colletieæ,* which, as far as I am aware, has not been noticed by botanists: I refer to the peculiar deve-

lopment of the stipules. Brongniart, who enters fully into detail respecting the several parts of the plant in the *Rhamnaceæ*, in describing their stipules, does not allude to it; he even states that these organs are entirely wanting in *Retanilla*, where I find this development to be a very characteristic feature. Beneath each spine and at the base of each petiole, a dark red-coloured broad scale is seen, which somewhat embraces the stem; it is concave, and terminates at the apex in two short teeth, or lengthened erect linear segments, the petiole appearing to spring from between them: in some instances, as in *Colletia, Talguenea, Trevoa, Adolphia,* and *Scypharia*, these stipular scales are simply amplexicaul; but in other cases, as in *Notophœna, Retanilla, Ochetophila,* and *Discaria*, those of the opposite axils unite in a short vaginal sheath, forming a dark transverse line around the stem, making each node seem to be articulated, as in *Ephedra*. Between each scale and its corresponding spine, a tubercular swelling originates, upon which both leaves and flowers appear, when, as frequently occurs, they are fasciculated: this tubercle is, in fact, a suppressed or undeveloped branchlet; the scales are the opposite stipules of the approximated decussating axils, some of which are sterile, while others produce both leaves and flowers, or each separately. This feature affords a very good discriminating character in some of the genera.

After these prefatory remarks, I proceed to the consideration, in succession, of the several genera of the *Colletieæ*, separating the tribe into three divisions:—1, where the petals are wanting, and the fruit is separable into distinct cocci; 2, where petals are present, with a similar fruit; 3, where petals are also present, but where the fruit is indehiscent.

Division 1. **Eucolletieæ.** Flores apetali; fructus capsularis, dehiscens.

1. Colletia.

A very good history of this genus is given by Sir W. Hooker in his 'Botanical Miscellany' (i. p. 150), but some confusion has existed among its species, which I have endeavoured to clear away. The species are mostly confined within the extratropical regions of South America, on both coasts; some few have been found within the tropics, one of them by Humboldt, at Huancabamba, in Upper Peru, at an elevation of more than 10,300 feet above the sea. The greater portion are met with near the base of the Andes, both on the western and eastern sides, at an elevation of from 2500 to 6000 feet, while others are seen only on the maritime sandhills along the coasts of Chile and in the low grounds bordering the river Plate. Commerson's plant, said by Jussieu to be from Brazil, is from the province of

Buenos Ayres: one species is a native of the island of Juan Fernandez, in the Pacific. The genus is readily distinguished from most others of the *Colletieæ* by the absence of petals,—a character partaken of only by one other, which I have proposed under the name of *Notophæna*, from which it is at once recognized by the peculiar form of its disk. In many genera of the tribe the tube of the calyx is circumscissile in the line of its contraction above the basilar intumescence; *Colletia* differs from them in having its circumscissile zone midway between that line and the base, so that when the tube falls away, it carries with it its annular disk, and when seen from below, it seems closed by a diaphragm, pervious only for the passage of the style. When the fruit is half immersed in the persistent cupular base of the calyx, its epicarp forms a loose skin, which breaks round the margin of the cup, leaving its lower moiety persistent within it, while the upper moiety splits at the same time, to allow the separation of the three cocci (consisting of endocarp), which spring out of the calycine cup with elastic force, each coccus bursting by its axial line, as in *Euphorbiaceæ*, &c.; the remaining portion of the epicarp attached to the cocci comes off like a loose skin; but the mesocarp, which is membranaceous, adheres to the corneous endocarp.

Colletia, Comm.—Char. emend. *Calyx* cylindricus vel urceolato-tubulosus, imo tumescens et hinc demum circumscissus, 8–10-striatus, limbo 4–5-fido, laciniis acutis reflexis, intus carina prominula calloque apicali notatis, æstivatione valvatis. *Petala* nulla. *Stamina* 4 v. 5, inter lacinias calycis, rarius sub faucem, inserta; *filamenta* subulata, compressa, laciniis fere æqualia vel breviora, erecta, apice sæpe inflexa; *antheræ* sub-2-lobæ, reniformes, oscillatoriæ, transversim 2-valves, valva antica quam postica breviore, et rima hippocrepica late hiante. *Discus* imo tenuissimus aut fere evanidus, ibique ad fundum calycis adnatus, margine (in coarctationem tubi) libero latissimo et convolutim inflexo hinc valde conspicuus, carnosus, et annularis. *Ovarium* superum, globosum, 3-sulcatum, 3-loculare; *ovula* in loculis solitaria, e basi erecta. *Stylus* filiformis, calyci æquilongus. *Stigma* parvum, obtuse 3-lobum. *Fructus* siccus, subglobosus, 3-sulcatus, calycis cupula semi-immersus, subcapsularis, in coccos 3 solubilis, coccis crustaceis, rima ventrali elastice 2-valvatim dehiscentibus, monospermis. *Semen* erectum, ovatum, vix compressum, ventre subangulatum; *tunica externa* nitida, durissima, cornea, *hilo* basali pervio et transversali; *integumentum secundum* membranaceum, et medio substantia laxe cellulosa subcoriacea opaca ad priorem agglutinatum, raphigerum; *raphe* filiformis,

e basi lateraliter orta, hinc cursu omnino peripherico apicem transiens, et tunc altero latere ad hilum iterum regrediens; *integumentum internum* præcedenti laxatum, membranaceum, subopacum, a medio sensim arctatum, et imo in cerviculam filiformem brevem terminatum, *chalaza* majuscula carnosa apicali munitum. *Embryo* intra *albumen* carnosum inclusus; *radicula* brevissima, infera, tereti, *cotyledonibus* carnosis foliaceis, planis, cordato-ovatis.—Suffrutices Americæ Meridionalis, plerumque extratropicales, intricato-ramosi, subaphylli, ramis decussatim, oppositis, divaricatis ramulis spinescentibus, spinis subulatis sæpe compressis, interdum latissime expansis et decurrentibus; folia paucissima, minuta, sæpe rudimentaria, opposita, integra; flores infra spinas orti, albidi vel albido-rosei, pedicellis 1-floris nutantibus.

1. *Colletia spinosa*, Lam. Illustr. ii. 90. tab. 129; Dict. Suppl. ii. 312; DC. Prodr. ii. 28.—C. horrida, *Willd.* i. 1113; *Vent. Hort. Cels.* 92.—C. polyacantha, *Willd. in R. & Sch.* v. 113.—Rhamnus Yaquil, *Domb. MSS.*;—spinosissima, ramulis spinisque compressis valde striatis, striis in ramulis spiraliter, in spinis recte parallelis, spinis validis, longiusculis, decussatis, subulatis, apice callo acutissimo rubro terminatis; foliis parvis, oblongo-ovatis, glaberrimis, integris, aut summum versus denticulatis, caducissimis, breviter petiolatis, infra spinas insertis; floribus solitariis, vel paucis fasciculatis e tuberculo sub spina ortis, pedunculis brevibus reflexis; calyce cylindrico, medio constricto, imo ampliore et subgloboso, limbi laciniis 5, reflexis, acutis, apice callo instructis, staminibus parvulis ore fere sessilibus, filamentis brevissimis deflexis.—Buenos Ayres: —*v. s. in herb. Jussieu, in Mus. Paris* (Commerson).

This species must be considered as the type of the genus which, according to Jussieu (Gen. Plant. p. 380, ann. 1789), was first proposed by Commerson for a plant of his collection, who, however, assigned to it no specific designation: its first name, *Colletia spinosa*, was given by Lamarck (in 1793), in his 'Illust. Gen.' tab. 129. Willdenow (in 1798) published the same plant, the only species then known, under the name of *Colletia horrida*. Poiret (in 1811) first detailed the characters of the genus, and Ventenat, in the meantime, figured and described two other plants, which he referred to *Colletia*. Poiret states (Encycl. Meth. Suppl. ii. 312) that Lamarck figured his type from the plant brought from Peru by Jos. de Jussieu, and from Brazil (Buenos Ayres) by Commerson; but he evidently confounded two species together. I have seen the original specimens of these two plants, which are preserved in the Jussieuan Herbarium, and fastened on the same sheet. Commerson's specimen

above described appears to be that figured by Lamarck as *Colletia spinosa*; Jussieu's plant, of which there are two small specimens, one in flower, the other in seed, corresponds with another larger specimen collected also in Peru (Tarma) by Dombey, which I have described under the name of *C. aciculata*. Lamarck's figure, though coarsely drawn, is tolerably correct; but the spines in the specimen are longer than are there represented, and not at all curved. I have adopted from his description and plate the character of the leaves which are now wanting in the two existing specimens, both collected by Commerson in "Buenos Ayres," or at least in the Argentine Provinces. In the full-grown specimen, the spines are an inch long, and a line in diameter at the base; in the younger specimen, with the flowers in bud, the spines are somewhat shorter, more slender, and more terete; they are all of a dark green colour when dried. The leaves in Lamarck's figure are 4 lines long and 2 lines broad. The slender reflexed peduncles are about a line long; the tube of the calyx is 2–2½ lines long, 1½ line in diameter, its segments being 1 line long and ½ line broad*.

2. *Colletia intricata*, n. sp.;—spinosissima, glaberrima, ramulis compressis, spinis longis, curvulis, spinulisque decussatis, teretibus, subulatis, apice callo acuto rubro pungentibus; foliis rarissimis, oppositis, oblongis, crassiusculis, obtusis, dentatis, 3-nerviis, imo in petiolum sublongum canaliculatum gradatim angustatis, e sinu dentium stipulæ minutæ enatis; floribus pro genere majusculis 2–3, fasciculatis, e tuberculo squamoso infra spinas prodeuntibus, nutantibus; calyce cylindrico, tubo amplo, 10-nervio, rubescente, imo carnoso, limbi laciniis 5 albis, reflexis; staminibus in sinubus subsessilibus, filamentis brevissimis.—In Andibus Mendocinis et Chilensibus:—circa Uspallatam (altit. 6000 ped.) et procul Mendoza (2600 ped.) mihi lecta;—*v. s. in herb. Hook.* in Andibus Mendozæ (Gillies);—Chile (Bridges), a Valparaiso missa, sed forsan in Andibus lecta. Vernac. *Yaquil.*

This differs from the typical species in its longer, more slender, and more terete, obsoletely striated spines, in its general glaucous hue, in the form of its leaves, which are denticulated, and more especially in its conspicuous and larger flowers. It forms a low, branching, spiny, and almost leafless shrub. Its decussating nodes are half an inch apart; its spines are opposite, from 7 to 15 lines long; the leaves are 3 lines long, 1½ line broad, upon a petiole of 1 line in length; the petiole is inserted in a sharp notch on the apex of a minute rigid stipular scale

* A figure of this species, with analytical details, will be given in the 'Contributions to Botany,' plate 34 A.

beneath each spine, between which is seen the squamose tuft out of which the flowers spring. The flowers are of a deep rose colour, with a white reflexed border, and are larger than the other species of the genus; the pedicel is 2 lines long; the calyx is tubular, not contracted in the middle, fleshy at base, 3 lines long and 2 lines in diameter, the segments of the border being in addition 1 line long and $\frac{3}{4}$ line broad*.

3. *Colletia invicta*, n. sp.;—spinosissima, ramulis spinisque compressis, glauco-pruinosis, subflavis, et molliter puberulis, spinis 3-seriatim spinulosis, crebris, validis, intricatis, apice callo rubro pungentibus; foliis in ramulis novellis parvulis, ovatis, utrinque acutis, crassiusculis, enerviis, margine crenulatis, ubique puberulis, subreflexis, subimplicatis, fere epetiolatis, caducissimis, e stipula enatis; floribus majusculis, roseis, 4–6 e tuberculo squamoso infra spinas fasciculatis, nutantibus; calyce cylindrico, tubo amplo, 10-nervio, rubro, imo carnoso, disco basin versus annulari, limbi laciniis 5, carnosulis, pallidis, reflexis; staminibus in sinubus parvis, filamentis brevissimis, stylo exserto.—Chile ?—*v. s. in Herb. Mus. Paris* (*sine designatione*).

This is very different in habit from the former, being of a deep yellow hue, somewhat pubescent, with much shorter and thicker spines and closer axils. The primary spines are $1\frac{1}{2}$–2 inches long, the secondary spines $\frac{1}{2}$–$\frac{3}{4}$ inch long, and 4 lines apart, and the tertiary spinelets are 3 to 4 lines long, all forming a dense entanglement; the leaves are channelled above, about 2 lines long, 1 line broad, tapering into an almost obsolete sulcated petiole; the pedicels are 2 lines long; the tube of the calyx is 3 lines, and the segments 1 line long: it is quite cylindrical, and 2 lines in diameter; the filaments are only $\frac{1}{4}$ line in length, the anthers globose. The flowers much resemble those of the preceding species in size and form, but the annular disk is placed nearer the base of the tube; they are quite glabrous.

4. *Colletia ferox*, Gill. & Hook. Bot. Misc. i. 154. tab. 44 B;—implexo-spinosa, ramulis abbreviatis, aphyllis, viridibus, spinisque oppositis, subulatis, compressis, iterumque decussatim spinosulis, substriatulis, pungentibus, hinc confertim intricatis; floribus rosaceis 2–3, fasciculatis, sub spinis e tuberculo squamoso ortis; pedunculo flore paulo breviore, calyce medio constricto, imo subgloboso, limbi laciniis 5, reflexis, staminibus 5 parvulis in fauce inter lacinias fere sessilibus; stylo exserto; fructu 3-lobo, subgloboso, cupula calycina

* This species will be shown in the 'Contributions,' plate 34 B.

suffulto.—In Andibus Chilensibus et Mendocinis.—*v. s. in herb. Hook.* (Gillies, Cuming).

This species is very different in its general appearance from the three preceding, its spines being much shorter, very much entangled, of a dark colour; its flowers are smaller, and more contracted in the middle. The primary spines are 2–2½ inches long, the secondary are ½ to 1 inch, the tertiary spinelets are 2 to 4 lines; they are all quite glabrous. The pedicels are very slender, 2 lines long; the calyx, including the segments of its border, is 3 lines long and 1½ line in diameter in the mouth; the flowers are of a pale reddish-white colour, and of thin texture*.

5. *Colletia atrox*, n. sp.—Discaria Americana, *Hook. in parte, Bot. Misc.* iii. 172;—horride spinosa, ramulis pallide olivaceis, striatulis, spinis elongatis, validissimis, crassis, secundariisque brevibus decussatim oppositis, glaberrimis, valde compressis, imo latis et hinc subdecurrentibus, pallide viridibus, apice calloso-pungentibus, aphyllis aut foliis caducissimis; floribus majusculis, palidissimis, 2–8, fasciculatis, e tuberculo squamoso ad basin spinarum enatis; pedunculo flore paulo breviore, calyce late tubuloso, medio subconstricto, textura tenui, albido, imo inflato, limbi laciniis 5 revolutis; antheris parvulis, globosis, in ore fere sessilibus, stylo exserto, imo articulato, et mox caduco, ovario globoso, 3-lobo.—Buenos Ayres.—*v. s. in herb. Hook.* (Tweedie).

The strong and flattened spines of this plant give it a peculiar character, which indicates an approach to the following remarkable species. The branchlets are about 4 inches in length, the primary spines 1½ inch long, gradually diminishing upwards; their secondary spines, in one, two, or three almost horizontally salient decussating pairs, are from 3 to 6 lines long, much flattened and spreading at their base, where they are 2 lines broad and half a line thick, all armed with a reddish, sharp, callous point; they are of a greenish pallid hue. The flowers, in clustered fascicles, are nearly the size of those of *C. intricata*, and of the same pale colour; the tube is more globose at the base, and much contracted in the middle, 2½ lines long, the diameter of its mouth 1½ line, and the reflected segments 1 line in length: the slender peduncles are 2 lines long. This plant, by mistake, is confounded with *Discaria Americana* in the 'Botanical Miscellany'†.

* A representation of this species will be given in the 'Contributions,' plate 34 c.

† A drawing of this plant will be given in the same work, pl. 34 D.

6. *Colletia cruciata,* Gill. & Hook. Bot. Misc. i. 52. tab. 43; ibid. iii. 172.—C. Bictonensis, *Lindl. Journ. Hort. Soc.* v. 29 cum icone.—Condalia paradoxa, *Spr. Syst.* i. 825;—suffruticosa, 3–4-pedalis, ramosa, ramulis subangulatis, spinis magnis, horridis, decussatim oppositis, valde compressis, latissime expansis, longe decurrentibus, et apice calloso-pungentibus ubique tectis; junioribus pilis incanis adpressis hirsutulis sparsim tomentellis, foliiferis; foliis perpaucis, cito caducis, ellipticis, dentatis, apice acutis et mucronatis, basi in petiolum brevem canaliculatum attenuatis, sub spinis e stipula 2-dentata enatis; floribus parvis 6–8, fasciculatis, e tuberculo squamoso tomentoso ad basin spinarum ortis, pedunculo flore breviore, calyce cylindrico, albo, basi viridi, medio non constricto, obscure 10-nervio, limbi laciniis 5 patentibus, staminibus 5 parvis fere sessilibus inter lacinias sitis, stigmate obsolete 3-lobo, incluso.—Banda Oriental.—*v. s. in herb. Hook.*—Maldonado (Gillies).

This plant was raised in England many years since, and then erroneously supposed to be a hybrid, or a monstrosity of *C. spinosa,* and was described by Dr. Lindley under the name of *C. Bictonensis.* It is the most remarkable species of the genus, on account of its monstrous spines, which are flattened, and extend from one axil to another in cruciating and divaricating pairs: they are nearly an inch long and 3 to 6 lines broad at their base. Its leaves are very caducous, oblong, acute, with a mucronate apex, more obtuse at the base, fleshy, obsoletely 3-nerved, toothed on the margin, quite glabrous, 2 lines long, 1 line broad, on a slender petiole of 1 line in length; this springs out of a sinus of a bidentate acute stipule, also caducous. The flowers are smaller than in any of the preceding species, and are of a whitish colour: the length of the tube is 1½ line, of its reflected segments 1 line, its diameter 1 line. The annular perigynous disk is green, and situated near the base of the tube; the filaments are one-fourth of the length of the segments, and are reflected within the mouth; the style is exserted. The capsule is 2½ lines in diameter, 3-lobed, and seated in the free cupular persistent base of the calyx*.

7. *Colletia Weddelliana,* n. sp.;—intricato-spinosa, ramulis nodos versus compressis, ochraceo- vel glauco-pruinosis et granulato-punctatis, spinis teretibus, imo compressis, substriatis, iterumque spinulosis, apice glanduloso-pungentibus; foliis parvis, caducissimis, lanceolato-oblongis, utrinque acutis, integris vel summo dentatis, pallide glaucis, crassis, enerviis, convexis, rachi superne sulcata, inferne prominula, petiolo brevissimo,

* This species will be represented in the 'Contributions,' plate 34 E.

canaliculato, deflexo; floribus paucis, fasciculatis, e tuberculo squamoso majusculo puberulo proficiscentibus; calyce cylindrico, 10-nervi, rubello, medio non constricto, imo carnosulo, limbi laciniis 5 reflexis, 3-nerviis, apice callosis, staminibus 5 in sinubus fere sessilibus, disco annulari crenulato, stylo incluso.—Bolivia, in locis aridis petrosis, Puna ad Lac. Titicaca, altit. 12,000 ped.—*v. s. in herb. Mus. Paris* (Weddell, 4391).

This species much resembles *C. atrox* in general aspect, but its spines are not so broad and compressed at their base, and are of a more glaucous-yellow hue; the form of the calyx corresponds more with that of *C. spinosa* in being broad and little constricted. The spines vary in length from 6 to 9 lines, are greatly divaricated or nearly patent, and are decussating, the internodes being 4 to 6 lines apart. The leaves are 3 lines long, $1\frac{1}{4}$ line broad, thick, coriaceous, convex and channelled above, concave below, with revolute toothed margins; each pedicel is 1 line long; the length of the calyx (including its reflected segments, of nearly 1 line) is $3\frac{1}{2}$ lines, and its diameter $1\frac{1}{2}$ line*.

8. *Colletia Kunthiana.* C. spinosa, *H. B. K. Gen. Sp.* vii. 59 (non Lam.).—Fruticosa, 1–2-orgyalis, ramosissima, et intricato-spinosa, ramulis obsolete striatis, fusco-brunneis, adpresse hirtellis, ad nodos compressis, spinis subbrevibus, validis, subcurvulis, acumine calloso-pungentibus, junioribus foliiferis; foliis subsessilibus, parvulis, spathulato-lanceolatis vel obovatis, obtusis, integerrimis, concavis, infra carinatis, caducissimis, petiolo brevissimo, imo stipulis 2 ovatis minutis coadunatis instructo; floribus 1–4, fasciculatis, e tuberculo squamoso prodeuntibus; pedunculo flore pendulo breviore, calycis tubo rubescente tenuiter membranaceo, 10-nervio, basi tumido, limbi laciniis 5 acutis, reflexis, staminibus in sinubus fere sessilibus, stylo tereti, stigmate capitato-3-lobo, paulo exserto; capsula sub-3-loba, 3-cocca, cupula calycina, grandefacta, immersa, pisi magnitudine.—Huancabamba Altæ Peruviæ, altit. 10,300 ped.—Vernac. *Zarza de Moyse.—v. s in herb. Mus. Paris* (Bonpland) a cel. Kunthii missa.

This species has a fuscous hue, with short interlaced spinelets: the primary spines are 2 inches long; the secondary 8–10 lines, and 5 lines apart; the tertiary spinelets are 3 lines long, very stout, with a sharp point. The leaves are very caducous, and are wanting in the specimen I have seen, but they are described by Kunth. The flowers are small, of a reddish hue, many of them appear sterile, and soon fall off; the segments of the border are nearly as long as the tube, each being about 1 line long; and

* A drawing of this plant will be given in the 'Contributions,' plate 34 F.

the tube is cylindrical, 1 line in diameter; the disk is seated near its base: the pedicel is only $\frac{3}{4}$ line long in the flower, and 2 lines in fruit. The 3-lobed capsule, supported on the cupular remnant of the calyx, is $2\frac{1}{2}$ lines in diameter*.

9. *Colletia tenuicula*, n. sp.;—fruticosa, ramis teretibus, striatis, pallide olivaceis, pubescentibus, ramulis tenuibus, divergentibus, spinosis, spinis decussatim oppositis, acicularibus, simplicibus, nonnullis inferioribus iterum 2-spinulosis; foliis parvulis e ramulo novello inermi infra spinam enato, et ea dimidio breviore, crebriter approximatis et quasi fasciculatis; floribus 2–4 fasciculatis, infra spinas protensis, parvulis, pedicellisque gracilibus, glabris, erectis; calycis tubo rubescente infundibuliformi, tenuiter cylindraceo, imo globosim inflato, ore ampliore, limbi laciniis 5 acutis, revolutis; staminibus inter lacinias fere sessilibus, antheris parvis, globosis; ovario subgloboso, 3-sulcato, stylo filiformi, paulo exserto.—Patria ignota (forsan Buenos Ayres).—*v. s. in. herb. Mus. Soc. Linn. ex herb. Linn. fil. cum indicio* "Cavanilles 1803."

This is a delicate and slender species. The specimen above quoted is a mere fragment, 6 or 8 inches in length, originally contributed by Cavanilles to the younger Linnæus, whose herbarium passed into that of Sir Jas. Smith (now the property of the Linnæan Society). In habit it greatly resembles some of the species of *Discaria*, for which, at first sight, it might be mistaken. Its primary spines are very slender, almost acicular, of a pale green colour, pubescent, and about 2 inches long; the secondary spines, still more slender, are from 4 to 9 lines in length; the tertiary spinelets are only a line long: its filiform peduncles are $1\frac{1}{2}$ line long, the very slender tube of the calyx, including the segments, is 2 lines long, the tube being $\frac{1}{3}$ line in diameter†.

10. *Colletia pungens*, n. sp. C. spinosa, *Hook. in parte, Bot. Misc.* i. 154. tab. 44 A (*non Lam.*); *ibid.* iii. 173;—ramis ramulisque glaberrimis, pallide glaucis, aphyllis, aut foliis caducissimis, ad nodos compressis, horride spinosis, spinis longis, validis, divaricatis, decussatim oppositis, subulatis, striatis, apice callo rubro pungentibus: floribus parvis, binis, vel pluribus fasciculatis, e tuberculo squamoso tomentoso infra spinam vel interdum e medio spinarum ortis, pedunculo glaberrimo flore breviore, calycis tubo longiuscule cylindraceo, imo globose ampliato, limbi laciniis 4–5, acutis, reflexis, staminibus totidem sinubus insertis, filamentis longiusculis, exsertis, erectis, laciniis paulo brevioribus, antheris parvis, viridibus, stylo longe exserto.—In Andibus Chilensibus.—

* This species will be shown in the 'Contributions,' plate 35 A.
† A representation of this will be seen in the same work, plate 35 B.

v. s. in herb. Hook. La Guardia (Gillies); Mendosam versus (Gillies): Chile (Meyen): *in herb. Mus. Paris* (Gay, 2).

The general habit and appearance of this plant is like that of *C. spinosa,* Lam., but its flowers are much smaller, its stamens much longer, and ostensibly exserted: its armature is stouter, the primary spines are about 2 inches long, the secondary ones 6 to 9 lines long, diminishing upwards, and 4 to 5 lines apart; the flowers are numerous, frequently as many as eight from each spine: the pedicels are slender, 2 lines long; the length of the tube is $1\frac{3}{4}$ line, and of the segments 1 line, its diameter half a line; the filaments are erect, half the length of the segments; the style is exserted, and is deeply bullated or torulose all over its surface*.

11. *Colletia Spartioides,* Bert. Ann. Sc. Nat. xxi. 347; Hook. Bot. Misc. iii. 173; Colla, Mem. Torin. 37. p. 52. tab. 6;—sub-2-orgyalis, ramosissima, ramis virgatis, ramulis gracilibus, flexuosis, spinosis, junioribus sicco viridibus, pubescentibus, adultis glaberrimis, pallide glaucis, spinis subsparsis, decussatim oppositis, curvulis, compressis, longissimis, gracillimis, striatis, intricatis, apice pungentibus; foliis oppositis, spathulato-oblongis, basi attenuatis, margine serrulatis, obsolete 3-nerviis, glabris, petiolatis, e retinacula stipulari infraspinali breviter divaricata fusco-rubra 2-dentata ortis; floribus paucis, glomeratis, sub spinis enatis, pedunculo flore breviore, calyce breviter cylindraceo, imo globosim inflato, limbi laciniis 5 acutis, revolutis, staminibus erectis, laciniis dimidio brevioribus.—Insula Juan Fernandez.—*v. s. in herb. meo et in herb. Mus. Paris* (Guillemin, Bertero); in *hb. Hook.* (Bertero, 1448; Cuming).

This species is remarkable for its broom-like habit and the branchlike length of its extremely slender and lax spines. Bertero describes it as a tree 8 or 10 feet in height, with whitish flowers of a rose-coloured tint, and as being almost bare of leaves: its leaves, however, are larger than in any other species, measuring 9 lines in length (including a petiole of 1 line) and $2\frac{1}{2}$ lines broad. The pedicels are $1\frac{1}{2}$ line long, the tube of the calyx 2 lines, the segments 1 line long, and the tube is $1\frac{1}{2}$ line in diameter; the position of the disk is marked by a line of constriction above the semiglobose base of the calyx. The fruit, surmounted by the persistent style, is nearly globose, 2 lines in diameter, and supported by the lax persistent cup of the calyx†.

12. *Colletia cataphracta,* n. sp.;—intricatissime spinosa, fulvo-tomentella, aut parce pilosula, ramis elongatis, strictis, ramulis

* A figure of this species will be given in the 'Contributions,' plate 35 c.
† This species will be shown in the same work, plate 35 D.

teretibus, ad nodos subcompressis, erectiusculis, spinis crebriter decussatis, nonnullis iterumque spinulosis, breviusculis, sulcato-striatis, pallidiusculis, apice calloso-pungentibus; foliis minusculis, ovatis, utrinque acutis, apice mucronatis, enerviis, glaberrimis, caducissimis, petiolo canaliculato, subreflexo, sub spina in sinu stipulæ minimæ rigidæ apice 2-dentatæ inserto: floribus plurimis, parvulis, fasciculatis, e tuberculo squamoso stipula suffulto enatis, pedunculo subbrevi, calycis tubo medio angustato, subinfundibuliformi, imo globosim inflato, limbi laciniis 5 revolutis, staminibus 5, laciniis æquilongis, erectis, stylo antheras parvas globosas attingente.—Chile meridionalis; *in herb. meo* (Miller).

This specimen was given to me by Dr. Miller, who I believe obtained it in the south of Chile, from the neighbourhood of Concepcion. Its main branch is perfectly straight, a foot in length from where it has been cut off, having evidently been longer; it is $1\frac{1}{2}$ line in thickness: the primary nodes are $1\frac{1}{2}$ inch distant, the secondary and tertiary 3 lines apart; the primary spines or branchlets are 1 to $2\frac{1}{2}$ inches long, gradually decreasing upwards; the secondary spines are 9 lines, the tertiary 3 or 4 lines long, all terminated by a reddish corneous sharp point; the leaves, including the petiole, measure only a line in length, and $\frac{1}{3}$ line in breadth; the flowers are small, and of a pale whitish colour; the peduncle is $\frac{1}{2}$ line long, the tube of the calyx $1\frac{1}{4}$ line in length, the segments $\frac{1}{2}$ line long, the tube barely $\frac{1}{2}$ line in diameter*.

13. *Colletia armata*, n. sp.;—intricato-ramosa, ramulis subcompressis, sicco fusco-olivaceis, parce pubescentibus, spinosissimis, spinis elongatis, subpatentibus, striatis, iterumque longiuscule spinulosis, apice acute pungentibus: foliis utrinque glabris, ovatis, imo obtusis, aut vix acutis, remote dentatis, fortiter 3-nerviis, nervis supra sulcatis, petiolo brevi canaliculato reflexo, stipula rigida 2-dentata suffulto; floribus 2–5, e tuberculo stipula sustentato infra singulam spinam ortis, vel e medio spinæ nascentibus: pedunculo flore paulo breviore, calycis tubo late cylindrico, limbi laciniis 4–5, oblongis, acutis, reflexis, staminibus totidem, erectis, laciniis dimidio brevioribus, stylo vix exserto.—Chile.—*v.s. in herb. meo* (Bridges, 140); *in herb. Mus. Paris,* Valdivia (Gay, 49); Chile (Gay); Valparaiso (Gaudichaud, 1268); Monte La Leone (Bertero); Valdivia, Rio Callecalle (Lechler, 391).

The species is recognized by the unusual length and distance of its spines, which are somewhat curved, and not stout. The branchlets, in my specimen, are about 7 inches long, and barely a line in diameter: the primary spines are from 1 to 2 inches

* This will be illustrated in the 'Contributions,' plate 35 E.

long, and about $\frac{3}{4}$ inch apart; the secondary spines are from 7 to 10 lines long: the oblong leaves, with a toothed margin, are 3 to 5 lines long, $1\frac{1}{2}$ to $2\frac{1}{2}$ lines broad, decurrent on a deeply channelled deflected petiole 1 line long; the nervures are sulcated on the upper surface, and prominent beneath: the flowers are small and pale, clustered together upon a large scaly tubercle; the pedicels are 1 line long, the tube, contracted for some length in the middle, is 2 lines, and its segments $\frac{3}{4}$ line long; it is $\frac{3}{4}$ line in diameter: the peduncle in fruit is thicker, 2 lines long, and the 3-lobed capsule is $2\frac{1}{2}$ lines in diameter. In Bridges's and one of Bertero's specimens, the spines are much stouter and longer, much paler, yellowish, being $1\frac{1}{2}$ to $2\frac{1}{4}$ inches long, and a line or more in thickness, and they bear no spinelets, but two pairs of floriferous nodes upon each*.

Var. *β. insularis*: spinosissima, spinis iterumque spinosis, validiusculis, striatis, foliis caducissimis; floribus 2–4 fasciculatis. —Insula Chiloë.—*v. s. in herb. meo et Hook.* (Capt. King).

This variety is very dissimilar in appearance to the foregoing, but has no tangible differential characters; it is of a darker olivaceous hue, and quite glabrous; the primary spines are 8 lines apart and $1\frac{1}{2}$ to 2 inches long, the secondary spines 3 lines apart and 6 to 9 lines long; the pedicels $1\frac{1}{2}$ line long, and the flowers are like those of the preceding.

14. *Colletia dumosa*, n. sp.;—suffruticosa, humilis, ramosissima, intricato-spinosa, fusco-viridis, ramulis tortuosis, teretibus, creberrime spinosis, parce pilosulis, spinis interdum ternatim verticillatis, iterumque spinulosis, spinulis oppositis, brevibus, teretibus, crassis, substriatis, imo et medio floriferis, apice callo glauco nitente pungentibus; foliis caducissimis, aut nullis; floribus albis 2–5, fasciculatis, glaberrimis, spinulis longioribus, e tuberculo squamoso ortis, fragrantibus, calyce pedunculo subæquilongo, imo tumido et 5-sulcato, medio constricto, limbi laciniis 5 acutis, reflexis, staminibus 5 laciniis fere æquilongis, erectis, antheris parvis, viridibus, stylo exserto, fructu 3-cocco.—Chile.—*v. v.* ad Concon, in dumetis arenosis maritimis frequens: vern. Junco.—*v. s. in herb. Mus. Paris*: Chile (Gay, sub *C. ferox*): Chile (Gay, sub *C. spinosa*): Chile boreali (Pöppig); in arenas humidas Talcahuano (Lechler, 2794).

The drawing and floral analysis I made of this plant thirty-five years ago are still preserved, but my specimens were lost by shipwreck. I have still many of its seeds, which enabled me to investigate the seminal structure given in a preceding page. The species is closely allied to *C. armata*, but differs in its much closer axils and much shorter spines; the floral pedicels are

* A figure of this species will be given in the 'Contributions,' plate 35 F.

more elongated, and the stamens are longer and more exserted The primary spines or branchlets are 2–3 inches long, the secondary spines are 8–10 lines long and 3 lines apart, the tertiary spinelets are 4–5 lines in length and 2 lines apart; the secondary spines, often opposite, are frequently ternate; the pedicels are 2 lines long; the tube of the calyx, which is cylindrical and somewhat swollen at base, is $2\frac{1}{4}$ lines, and the segments $1\frac{1}{2}$ line long and $\frac{3}{4}$ line diameter; the filaments are erect, and $\frac{3}{4}$ line long*.

15. *Colletia veprecula*, n. sp. C. spinosa, var. pubescenti-incana, *Hook. Bot. Misc.* i. 154;—suffruticosa, intricato-ramosissima, ramulis strictis, teretibus, pulverulentis, spinis oppositis, interdum ternis, crebre decussatim spinulosis, puberulis, spinulis brevibus, approximatis, striatulis, apice callo rubro nitente pungentibus; foliis parvulis, late obovatis, apice rotundis, emarginatis, et mucronulatis, utrinque pubescentibus, serrato-dentatis, a medio basin versus integris, et hinc in petiolum brevem canaliculatum cuneatis, in ramulis novellis præstantibus, cito caducis; floribus 4–6 fasciculatis, parvulis, e tuberculo albido-tomentoso ortis; calyce pedunculo æquilongo, tubo cylindraceo, imo inflato, medio constricto, limbi laciniis 5 longiusculis, acutis, reflexis, staminibus laciniis dimidio brevioribus, erectis, stylo exserto stamina attingente.—Chile. —*v. s. in herb. meo*; Valdivia (Bridges, 141); Valparaiso (Cuming, 705);—*in herb. Hook.*; Concepcion (Beechey).

This is a very distinct species, with stout and very straight branchlets, 8 to 18 inches long, or perhaps longer, quite terete, pruinose, or sparsely tomentose; the primary spines, frequently ternate and very spreading, are scarcely longer than the internodes, which, together with their very divaricate spinelets, give to the branches an interrupted spicate appearance. The ramal internodes are $\frac{3}{4}$ inch apart, the primary spines are 1 inch long, the secondary spines are $\frac{3}{4}$ inch long and 2 lines apart, and the tertiary spinelets are 2 to 3 lines long; the leaves are suborbicular, broadly emarginate at the summit, and mucronate with 2 or 3 teeth on each margin: the petiole is seated in the sinus of a bidentate stipule. The flowers are numerous, and densely aggregated, owing to the very close proximity of the axils, so that the entire branch appears a full-flowered spike: the pedicels are somewhat more than a line long, the cylindrical tube of the calyx is $1\frac{1}{2}$ to 2 lines, and its segments $\frac{3}{4}$ to 1 line in length, its diameter being $\frac{1}{2}$ or $\frac{3}{4}$ line: the flowers are pale and membranaceous†.

* A drawing of this species, with analytical details of the structure of the seed, will be given in the 'Contributions,' plate 36 A.

† This plant will be represented in the same work, plate 36 B.

16. *Colletia aciculata,* n. sp.;—ramosissima, intricatissime spinulosa, viridis, breviter et rigide pilosula; ramis rectis, subteretibus, ramulis decussatis, crebre spinosis, spinis iteratim spinulosis, spinulis brevibus, sulcato-striatellis, acute pungentibus; foliis in ramulis novellis minimis, obovatis, paucidentatis, glabris, viridibus, imo in petiolum brevem cuneatis, caducis; floribus infra spinulas superiores fasciculatis, et hinc spicam cylindricam oblongam multifloram mentientibus, pedicello calyce breviore, calycis tubo late cylindrico, submembranaceo, imo inflato, carnosulo, limbi laciniis 5 acutis, subreflexis, staminibus 5 exsertis.—Peruvia: *v. s. in herb. Mus. Paris,* sine loco aut designatione, No. 901 (sub. nom. "Retama," Dombey); Tarma (Dombey, "vern. Naqui").

Three specimens of this plant exist in the Paris Museum: the first in flower, and the second in fruit, are in the Jussieuan herbarium, both upon the same sheet as the original typical species of *C. spinosa*; and these are probably the identical plants which Poiret confounded together, in his description of the typical species, as being brought from Peru (Dict. Suppl. ii. 312): the third specimen was also collected by Dombey at Tarma. It has much the habit of the preceding species, but its branches assume the appearance of a broader and more spreading spike: they are of a pale olive hue: the branchlets are straight and cylindrical, the primary spines are about $\frac{1}{2}$ inch apart and $1\frac{3}{4}$ inch long; the secondary spines are 3 lines apart, and $\frac{1}{2}$ to $\frac{3}{4}$ inch long; the tertiary spinelets are 2 to 3 lines long, all being clothed with fine sparse down. The inflorescence, owing to the closeness of the axils, covers the branchlets, each appearing like a densely flowered spike; the pedicels are 2 lines long; the cylindrical calyx, but little swollen, though tumid at base, is $2\frac{1}{2}$ lines, and the segments $1\frac{1}{4}$ line long, and $1\frac{1}{4}$ line diameter*.

17. *Colletia hystrix,* Clos, in Gay, Chile, ii. 32;—ramulis teretibus, rectis, rigidis, fuscis, pubescentibus, spinis brevibus, compositis, 3–4-natim verticillatis, secus ramos valde approximatis, et hinc intricatione formam longam cylindricam mentientibus, aut interdum nodos globosos interruptis emulantibus, omnibus pilis rigidis patentissimis vestitis, et apice calloso-pungentibus; ramulis novellis inermibus, et foliiferis, demum spinosis et aphyllis: foliis parvis, ovatis, integris, aut obsolete dentatis, membranaceis subglabris, 3-nerviis, apice mucronulatis, imo in petiolum brevem attenuatis; floribus sparsis, subfasciculatis, pedunculo tenui, calyce sicco pallide

* This species will be shown in the 'Contributions,' plate 36 c.

rosaceo, urceolato, medio constricto, imo globoso, limbi laciniis 5 reflexis, staminibus exsertis, filamentis erectis laciniarum quartam longitudinis, stylo filiformi, longe exserto, stigmate capitato-3-lobo.—Chile centralis. *v. s. in herb. Mus. Paris*;—versus pedem Andium (Gay).

This is a very distinct species, partaking much of the habit of the following, and somewhat of the two preceding. Dr. Clos remarks that, seen at a distance, its branches bear much the appearance of a *Cactus* or *Cereus*, owing to the length of its straight branchlets, and the extreme intricacy of its innumerable spines, and verticillated very short ramifications. The leaves are oval, rounded at the summit, cuneated at base into a short petiole: they are glabrous, toothed on the margins, $2\frac{1}{2}$ lines long, $1\frac{1}{2}$ line broad, on a petiole of $\frac{1}{2}$ line; the flowers are small and few, the pedicel is $1\frac{1}{2}$ line long, the tube of the calyx $1\frac{1}{2}$ line, and the segments $\frac{3}{4}$ line long, and it is 1 line in diameter, tumid and semiglobose at its base*.

Var. β. Valanzuelæ; Colletia Balanzuelæ, *Bert. MSS.*: differt spinis acicularibus, tenuioribus, et paulo longioribus.

18. *Colletia ulicina*, Gill. et Hook, Bot. Misc. i. 155. tab. 44 c; *idem.* iii. 173;—suffruticosa, orgyalis, vel sub-2-orgyalis, ramosissima, ubique rigide hirsutula, ramis teretibus, elongatis, ramulisque spinosissimis, et intricatione spinarum quasi cylindraceis, spinis duplo aut triplo spinulosis, aut oppositis, vel ternatim verticillatis, spinulis crebris, brevibus, tenuibus, decussatis, fusco-olivaceis, striatis, acutissime pungentibus; foliis abortivis; stipula minuta, subulata, fusca, ciliata, tuberculoque florifera sub spinula enatis; floribus copiosis, plerumque fasciculatis, rarius solitariis, et proximitate axillarum hinc spicato-congestis; pedunculo hirsuto, incurvo, flore subæquilongo; calycis tubo elongato, cylindrico, infra medium constricto, imo subgloboso, fauce ampliore, limbi laciniis 5 oblongo-ovatis, recurvulis, staminibus intra tubum paulo supra medium insertis, omnino inclusis, filamentis brevissimis, stylo tubo multo breviore, erecto, stigmate subcapitato, obsolete 3-lobo; fructu pisi magnitudine.—Chile, in Andibus.—*v. s. in herb. Hook.* fluv. Tinguiririca, alt. 3000 ped. (Gillies); Colchagua, in vallibus Andinis (Bridges, 1807); Chile (Gillies, 220); *in herb. Mus. Paris,* San Fernando, prov. Colchagua (Gay, 570).

This is a very distinct species, not only on account of its habit, but of its copious red flowers with an unusually elongated tube, and its included stamens: in all other species the insertion of the stamens is in the mouth, between the segments of the

* A representation of this plant will be given in the 'Contributions,' pl. 36 D.

border; here they originate far within the tube. Sir W. Hooker, on the authority of Gillies, describes it as being only 1 or 2 feet in height, with decumbent stems; Bridges, on the contrary, says that it grows to the height of 6 or 10 feet, which is more probable. It is found also in Rancagua, where it bears the name of *Cruzero*, appearing as a short tree, with a somewhat slender stem. A decoction is there made from its branches by the natives, who use it as a purgative. It comes into bloom in December and January. The branchlets are straight and terete, the primary spines are $\frac{1}{4}$ inch apart, generally verticillate, and $\frac{1}{2}$ inch long; the secondary spines are 4 lines long, and the tertiary spinelets about two lines long, and slender. In the Rancagua specimen, they are somewhat longer and stouter. The flowers are densely aggregated, and cover the spicated branchlets; the pedicel is $1\frac{1}{2}$ line long; the tube of the calyx is $3\frac{1}{2}$ lines long, the lanceolate segments 1 line long, and it is 1 line in diameter†.

Species exclusæ.

1. *Colletia affinis*, Clos.	=*Retanilla stricta**.
2. —— *articulata*, Phil.	=*Retanilla articulata**.
3. —— *australis*, Brongn.	=*Discaria australis*, Hook.
4. —— *Chacaya*, Don.	=*Ochetophila 3-nervis*, Pöp.
5. —— *crenata*, Clos.	=*Notophæna foliosa**.
6. —— *discolor*, Hook.	=*Notophæna discolor**.
7. —— *disperma*, DC.	=*Microrhamnus* ?
8. —— *Doniana*, Clos.	=*Ochetophila 3-nervis*, Pöp.
9. —— *Ephedra*, Vent.	=*Retanilla Ephedra*, Brongn.
10. —— *inermis*, Clos.	=*Ochetophila 3-nervis*.
11. —— *infesta*, Brongn.	=*Adolphia infesta*, Meisn.
12. —— *longispina*, Hook.	=*Discaria longispina**.
13. —— *Maytenoides*, Griseb.	=*Condalia Maytenoides* = *Sciadophila Maytenoides*, Phil.
14. —— *multiflora*, Moç. Sessè.	=*Adolphia infesta*, Meisn.
15. —— *nana*, Clos.	=*Ochetophila prostrata**.
16. —— *obcordata*, Vent.	=*Retanilla obcordata*, Brongn.
17. —— *pubescens*, Brongn.	=*Discaria australis*, Hook.
18. —— *serratifolia*, Vent.	=*Notophæna serratifolia**.
19. —— *serratifolia*, Hook.	=*Notophæna foliosa**.
20. —— *spicata*, Willd.	=*Scypharia senticosa**.
21. —— *tetragona*, Brongn.	=*Scypharia ? tetragona**.
22. —— *tetrandra*, Clos.	=*Trevoa Closiana**.
23. —— *tomentosa*, Phil.	=*Notophæna tomentosa**.
24. —— *Tralhuen*, Bert.	=*Talguenca costata**.
25. —— *Trebu*, Bert.	=*Trevoa 3-nervis**.

[To be continued.]

† This species will be shown in the 'Contributions,' plate 36 E.

XXIV.—*On Additions to the Madeiran Coleoptera.* By T. Vernon Wollaston, M.A., F.L.S.

Fam. **Carabidæ.**

Genus Apotomus.

(Hoffm.) Illiger, Mag. für Ins. vi. 348 (1807).

Apotomus Chaudoirii.

A. rufo-ferrugineus, dense pubescens, capite prothoraceque nitidissimis; elytris profunde punctato-striatis; antennis, palpis pedibusque pallido-testaceis, antennarum articulis quinto, sexto et septimo nigrescentibus.

Long. corp. lin. 2.

Apotomus rufus, Woll. [nec Rossi], Ins. Mad. 14 (1854).
—— ——, Woll., Brit. Mus. Cat. 6 (1857).

Habitat sub lapidibus in locis maritimis Maderæ et Portûs Sancti tempore vernali, passim.

Although I can scarcely persuade myself that the Madeiran *Apotomus* is anything more than a geographical state of the Mediterranean *A. rufus* (to which I have hitherto referred it), I am nevertheless induced to separate it therefrom on the high authority of the Baron Maxmillian de Chaudoir, who has lately informed me that he considers it specifically distinct; and I feel the more bound to do this on account of the great attention which he had paid for many years to the *Carabidæ.* I have therefore much pleasure in dedicating it to him. It seems to differ from the ordinary European form in the much paler colour of its antennæ, palpi, and legs, the first of which, moreover, have their fifth, sixth, and seventh joints very much darker than the remainder,—the basal four and apical four being always pale. The Baron Chaudoir also pointed to some difference in the pubescence; but, on comparing the Madeiran examples with specimens which I possess from the south of France and Corfu, I cannot detect anything peculiar in this respect.

Genus Zargus.

Wollaston, Ins. Mad. 22, tab. i. f. 4, 5, 6 (1854).

Zargus Monizii, n. sp.

Z. nigro-piceus, fere concolor (marginibus vix dilutioribus), nitidus, subdepressus; prothorace parvo angusto subquadrato; elytris striatis; antennis basi pedibusque pallidis, infuscatis, illis apicem versus fusco-piceis.

Long. corp. lin. $3\frac{1}{2}$–$3\frac{2}{3}$.

Habitat in Madera australi, a cl. Dom. Moniz. mense Decembri A.D. 1858 repertus.

Z. dark-piceous, and almost concolorous (the margins of the

prothorax and elytra being scarcely at all diluted in colouring), shining, and somewhat depressed. *Mouth* prominent, and rufo-piceous. *Prothorax* small, narrow, and subquadrate, with the sides just perceptibly more straightened towards the posterior angles than is the case in the *Z. pellucidus*, and therefore a trifle more suddenly widened a little before the middle; with very slight indications of wrinkles, and with a deep dorsal channel. *Elytra* ovate, regularly and rather deeply striated,—the striæ having no tendency at all to being interrupted, and with the interstices flattened; with two small depressions on the disk of each, the hinder one of which is sometimes obsolete; and with the humeral angles a trifle more produced, or acute (the arc from either shoulder to the scutellum being generally more *regularly* curved), than in the *Z. pellucidus*. *Antennæ* and *legs* slender; the *former* rufo-testaceous at their base, and brownish-piceous towards their apex; the *latter* with their *femora* pale, and the *tibiæ* and *tarsi* rufo-testaceous.

The discovery of this important addition to the Madeiran fauna is due to the researches of Señor Moniz, who captured several specimens of it, from beneath stones, on the slope behind the sea-beach in the little bay immediately within the Brazen Head (in Madeira proper), during December of 1858. It approaches closely to the *Z. pellucidus*; nevertheless, its uniformly larger size and darker hue will, apart from minor characters, at once distinguish it from that species.

Genus *Aëpys.*

(Leach), Samouelle, Usef. Comp. 149 [script. *Aëpus*] (1819).

Aëpys gracilicornis, n. sp.

A. fusco-testaceus subopacus, depressus, densissime et rugose alutaceus punctisque remotis leviter impressus necnon pube demissâ pallidiore (præsertim in elytris) vestitus; prothorace angusto subcordato; coleopteris parallelo-subellipticis haud striatis, singulo punctis duobus leviter signato necnon ad apicem rotundato; antennis pedibusque pallidioribus et (illis præcipue) elongatis gracilibus.

Long. corp. lin. 1.

Habitat Maderam borealem; in litore quodam parvo abrupto lutoso lapidoso maritimo ad Sanctum Vincentium mense Decembri A.D. 1858 plurima specimina deprehendi.

A. brownish-testaceous (sometimes almost testaceous-brown), nearly opake, depressed, densely alutaceous all over (roughly so on the head and prothorax), and with ill-defined, rather remote and shallow punctures intermixed (which are deeper and larger on the head and prothorax, especially the former, than on the

elytra), and clothed all over (sparingly on the head and prothorax, but thickly on the elytra) with decumbent paler hairs. *Head* large, and with two very deep, curved, longitudinal furrows down the forehead; *eyes* depressed and very minute. *Prothorax* narrow and subcordate, finely margined, and with the extreme posterior angles almost right angles; with a distinct dorsal channel, and with a small fovea on either side behind. *Scutellum* rather large, and posteriorly acute. *Elytra* somewhat parallel-elliptic, and unstriated; each of them separately rounded off at the apex, and with two shallow impressions on its disk. *Antennæ* and *legs* rather paler than the rest of the surface, and (particularly the *former*) elongated and slender.

The present very interesting addition to the fauna was detected by myself on the 16th December, 1858, in the muddy crevices of the low sea-bank which terminates the marshy piece of ground at the mouth of the São Vicente river (in the north of Madeira proper), adjoining the small chapel-rock. It was very active and gregarious; and I obtained a few specimens, likewise, from beneath the shingle and stones which must have been almost washed by the sea-water at high tides. It has all the habits, therefore, of the *A. marinus* of higher latitudes, from which, however, in its specific details, it is abundantly distinct. Thus, its darker, alutaceous, nearly opake, punctured (although lightly so) and pubescent surface, in conjunction with its posteriorly acuter scutellum, narrower prothorax, and less parallel (or more elliptic) elytra, will readily separate it from that insect. Its antennæ, too, are very much longer and less robust, with their joints (particularly the terminal one) altogether longer and slenderer and more loosely connected *inter se* (or, as it were, perfoliated). In its essential characters, however, it is a true *Aëpys* (which has been also confirmed by my friend Dr. H. Schaum of Berlin),—its minute flattened eyes, separately-rounded, shortened elytra, and curved frontal furrows, apart from the structure of its palpi, labrum, and feet, as well as its small size, soft texture, pallid hue, apterous body, general contour and submarine mode of life, at once assigning it to that genus.

Fam. **Silphidæ.**

Genus Catops.

Paykull, Ins. Suec. i. 342 (1798).

Catops Murrayi, n. sp.

C. subellipticus, piceo-niger, minus convexus; prothorace postice sinuato; elytris apice leviter acuminatis, singulo stria suturali

antice evanescente impresso; antennis pedibusque longiusculis robustis rufo-ferrugineis.

Long. corp. lin. $1\frac{2}{3}$.

Mas tarsorum anteriorum articulo basilari magno dilatato.

Habitat elevata humida Maderæ sylvaticæ, in "Boa Ventura" mense Decembri A.D. 1858 a meipso repertus. Catops valde indigenus, distinctus, et in honorem cl. A. Murray, armigeri, hujus generis investigatoris felicissimi, dicatus.

C. subelliptic, slightly depressed, dark piceous-black, and densely clothed with a coarse decumbent pile, which is yellowish on the head and prothorax, but darker on the elytra. *Head* and *prothorax* slightly shining; the former distinctly, and the latter (which is sinuated along its hinder margin) minutely punctulated. *Elytra* widest a little behind their middle, and rather acuminated at their apex; each with an impressed stria near the suture,—tolerably deep posteriorly, but vanishing in front. *Limbs* rufo-ferruginous, and rather long and robust: *antennæ* a good deal thickened towards their apex, and with their eighth joint *very distinctly* smaller than the neighbouring ones; *tibiæ* (at any rate in the males, for which alone I can answer) a good deal curved.

Male with the basal joint of the four anterior feet much enlarged, being greatly dilated, and slightly lengthened, in the front pair,—and greatly lengthened, and slightly dilated, in the intermediate ones.

A single specimen (and that a male) of the present *Catops* was taken by myself at a lofty elevation in Madeira proper (just below the Boca das Torrinhas, at the head of the Boa Ventura, —some 4000 feet above the sea), whilst encamped there, with the Rev. R. T. Lowe, during December 1858. It belongs to another section of the genus than its Madeiran ally, the *C. velox*; and, apart from the slightly different proportions of its antennal and tarsal joints, and its more evidently curved tibiæ, it may be at once recognized from that insect by, *inter alia*, its larger size, and longer and more robust limbs; by its more elliptic outline, and less convex surface; by its posteriorly sinuated prothorax, and anteriorly evanescent sutural striæ; as well as by its coarser pubescence and more acuminated elytra. I have dedicated it to Andrew Murray, Esq., of Edinburgh, whose Monograph of *Catops* has rendered so great a service in determining the numerous species of that somewhat obscure and difficult genus. And I may add that I lately forwarded to him the unique Madeiran specimen described above, and have received his assurance that it is perfectly distinct from any species with which he is acquainted,—adding, "at the same time I have not much doubt as to its affinities: it certainly does not belong

to the section with overlapping thorax; and I should place it near *coracinus* and *nigrita*, but towards *scitulus* and *alpinus*."

Fam. **Trichopterygidæ.**

Genus Elachys.

Matthews, in litteris.

Elachys abbreviatellus, Heer.

E. minutissima, oblonga, pubescens, nigra, subnitida; prothorace elytrorum latitudine, ad latera rotundato, angulis posticis obtusis; elytris postice latiusculis truncatis abdomine paulo brevioribus; antennis pallide fusco-piceis, basi pedibusque dilute testaceis.

Long. corp. lin. $\frac{1}{4}$.

Habitat Maderam australem, sub foliis marcidis et quisquiliis, hinc inde vulgaris: in horto Bewickiano ad "Palmeira," prope urbem Funchalensem, abundat; necnon etiam ad S. Antonio da Serra parce cepit Dom. Bewicke.

Trichopteryx abbreviatellus, Heer, Fauna Col. Helv. i. 375 (1841).
—— *curta*, Gillm. in Sturm, Deutsch. Fauna, xvii. (1845).
—— *abbreviatellus*, Erich., Nat. der Ins. Deutsch. iii. 23 (1848).
Titan abbreviatellus, Matthews, in Zool. xvi. 6110 (1858).

E. excessively minute, narrowish, oblong, and black; closely roughened (but scarcely, perhaps, punctured), densely clothed with a decumbent silvery pile, and slightly shining. *Head* rather large and wide. *Prothorax* a good deal (and about equally) rounded at the sides,—being, therefore, narrower before and behind; at the latter of which it is distinctly margined, and of the same breadth as the base of the elytra. *Elytra* rather widened posteriorly and suddenly truncated, where they are a little shorter than the abdomen; and with their hinder margin a little pale. *Antennæ* pale brownish-piceous; their *base*, and the *legs*, diluted-testaceous.

The present insect is perhaps scarcely separable from the genus *Acratrichis* (i. e. *Trichopteryx*); nevertheless, since it was removed therefrom by the Rev. A. Matthews, in his 'Synonymic List of the British *Trichopterygidæ*' (*vide* 'Zoologist,' 6104, A.D. 1858), I have retained it as distinct. In his excellent Paper on these minute creatures, it was assigned by Mr. Matthews to the genus *Titan* of Newman; but, having been informed by him subsequently "that the term *Titan* must be altered," and that he intends "to propose *Elachys* in its place," I have quoted it accordingly. It seems to differ principally from the members of *Trichopteryx* proper by its hinder coxæ not being lamellated: nevertheless it has many external features of its own, in outline and general aspect, which would induce the suspicion that a close examination of its oral organs would disclose other cha-

racters which would tend still further to render its isolation desirable. It may be known from the other Madeiran *Trichopterygidæ* by, *inter alia,* its excessively diminutive size, and the form of its prothorax,—which has its sides greatly (and equally) rounded, and its hinder angles obtuse and not at all produced. There can be no doubt that it is identical with the European *T. abbreviatella,* though my Madeiran specimens are perhaps a trifle darker than British ones in my possession. They were detected abundantly by Mr. Bewicke and myself, in December 1858, amongst dead leaves and vegetable refuse, in his garden at the Palmeira—and also, subsequently, beneath decaying bundles of the sugar-cane at the Praia Formosa—near Funchal. And a single example was captured at S. Antonio da Serra, by Mr. Bewicke, during the summer of 1859.

[To be continued.]

BIBLIOGRAPHICAL NOTICES.

A Guide to the Quadrupeds and Reptiles of Europe; with Descriptions of all the Species: compiled from the Latest Writers. By Lord Clermont. London: John Van Voorst, 1859. Post 8vo.

It is now, we believe, generally admitted that the British Islands possess no peculiar indigens belonging to the Animal or Vegetable Kingdoms. Instances there are, certainly (such as *Spiranthes gemmipara* among Flowering-Plants, and *Tetrao scoticus* among Birds), of species not at present known to occur elsewhere; but when the fauna of Europe has been thoroughly investigated, these and similar exceptions will in all probability be found to be more satisfactorily classed as localized varieties of more widely distributed species. Such being the case, it seems obvious that we can hardly arrive at a perfect knowledge of the British Fauna and Flora without studying the Fauna and Flora of the larger area in which it is comprised. A general acquaintance with the whole is necessary to a particular knowledge of the part. It is for this reason that we receive with pleasure every attempt (such as that made by Lord Clermont in the present work) to enlarge the much too generally restricted range of the views of the 'British Naturalist,' and to induce him to pay some attention to the objects found in other portions of Europe, instead of confining himself entirely to such as happen to occur in the little corner of it which his nation occupies. "*Philosophus non habet patriam*" is a maxim which the English student of nature seems to be especially prone to forget. Numerous as are the works which have been published in this country upon the Mammals, Birds, Reptiles, and Fishes of Great Britain, we are not aware of a single book written in the English language upon the Vertebrates of Europe generally, or any section of them. Our authorities on European

Mammals are Blasius and Schinz; on Birds, Temminck, Schlegel, and Degland; on Reptiles and Fishes, Schinz and Bonaparte.

We begin to hope, however, that we are "progressing" (*Americanicè*) a little in this as well as in other respects. Besides the present work on the Mammals and Reptiles of Europe, the publication and, we believe, extended sale of Mr. Bree's 'Birds of Europe *not* observed in the British Isles,' show that our ornithologists are extending their views; and the numerous papers contributed to 'The Ibis' on the ornithology of different portions of the European area give further evidence in the same direction.

Again, out of the crowds of English tourists who annually scatter themselves over the face of Europe, many probably have a taste for natural history, or some wish to gain a general knowledge of the animals which they may meet with, provided the means be ready at hand. Lord Clermont's little book, the title of which we give above, offers them a clear and concise account of the species of two of the generally recognized divisions of vertebrated animals met with within the limits of our continent. The work is, as it is confessed to be in the preface, a compilation; but the descriptions are taken from the best authorities on the subject, and useful notes on the habits, localities, and distribution of the species in different countries are added. It might be objected that the arrangement and nomenclature are in some respects a little old-fashioned, and that it would have been better if the author had followed Blasius rather more closely in one division of his work, and Duméril and Bibron less closely in another. But such minor objections hardly detract from the general merit of the book, and we hope that the noble author will meet with such encouragement as may induce him to issue 'Guides' to the other divisions of European Vertebrates, compiled in a similar manner, equally convenient as travelling companions for the tourist and as handy books of reference for the student.

A Manual of the Subkingdom Protozoa, with a General Introduction to the Principles of Zoology. By Joseph Reay Greene, B.A., Professor of Natural History in Queen's College, Cork. London, 1858. Longmans. 12mo.

This little volume is the first of a series of manuals to be published under the superintendence of Professors Galbraith and Haughton, and intended for the use of students. There can be little doubt that in Zoology, at any rate, an English Handbook for students is at present a desideratum; and if the remaining sections of the Animal Kingdom are treated of by Professor Greene as ably as the very difficult subject to which the volume before us is devoted, this series of manuals will go far to supply this deficiency in our scientific literature. At the same time we fear that the conditions of a student's text-book have hardly been realized with sufficient care in the publication of this manual. When we look forward over the space to be covered by subsequent volumes, and compare it with that occupied by

the one now under consideration, we cannot but think that the entire series will be too bulky for the ordinary student; and the cost will certainly be considerable.

The General Introduction to the Principles of Zoology occupies about twenty pages, and, although necessarily brief, is written in a sound and philosophical spirit. Our author is evidently a disciple of the most advanced school of zoology; but he treats disputed questions with great fairness, and evidently allows due weight to the arguments on both sides.

In his treatment of the group to which the present manual is especially devoted, Professor Greene exhibits the same characteristics: he has with great care brought together all the well-established information that we possess upon the Protozoa, and at the same time indicated where our knowledge is defective. The most recent contributions to the history of these minute organisms have been conconsulted by the author, and their leading results embodied in his work; and the student will be greatly assisted in his investigations by a well-selected and classified bibliographical list, including the most important works and papers published on the different groups of Protozoa.

The groups admitted by Professor Greene are as follows:—

1. *Rhizopoda*, under which we find an analysis of the classifications of D'Orbigny and Schultze, the latter with the equivalents of the groups in D'Orbigny's system, both of which, however, the author justly characterizes as "premature;" 2. *Polycystinæ*; 3. *Spongidæ* (for which we should have preferred the term *Porifera*); 4. *Thalassicollidæ*, to which the *Acanthometræ* of J. Müller are appended; 5. *Gregarinidæ*, including *Prorospermiæ*; and, 6. *Infusoria*, as to the nature of which Professor Greene adopts the view put forward by Lachmann and Carter in papers published in this Journal. The curious and problematical genus *Noctiluca* is described under the last-mentioned group, of which it is possibly an aberrant member.

In conclusion, we have much pleasure in recommending Professor Greene's Manual as a guide to those who are engaged in the study of zoology, and we can only hope that the succeeding volumes may be published fast enough to prevent a new edition of the first being necessary before the concluding one makes its appearance.

Letters from Alabama, chiefly relating to Natural History. By PHILIP HENRY GOSSE, F.R.S. 12mo. London: Morgan and Chase, 1859.

MR. GOSSE informs us that his object in visiting the little known State of Alabama was partly to establish a school in one of the rural districts, and partly to take advantage of his position to investigate the natural history of that part of the world. The little book to which we now call the attention of our readers is the result of this expedition.

It consists of a series of letters, which we may remark *en passant*

appeared singly in a periodical called the 'Home Friend,' and commences with an account of the author's outward voyage and of his journey up the Alabama River to his destination, in the course of which he found opportunities of making numerous observations on the natural history of the country traversed, which are described, as usual with Mr. Gosse, in a pleasant, lively style. Mr. Gosse then gives us a short account of the nature of his scholastic duties, and afterwards a history of his proceedings in the out-of-the-way locality where he took up his abode for seven or eight months, which includes a great many interesting observations on the natural history of the district, and especially on its entomology, described in an agreeable, gossiping manner. Interspersed with these, we find numerous characteristic remarks on the mode of life of the rough-and-ready southern planters amongst whom our author found himself located, their field sports, and their dexterity with the rifle. The *institution* also comes in for its share of notice, and, as may be expected, is not mentioned with any favour. The little work is illustrated with several nicely executed woodcuts, and is altogether a pleasing contribution to the stock of popular Natural History literature.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

Dec. 15, 1859.—Sir Benjamin C. Brodie, Bart., President, in the Chair.

"Note respecting the Circulation of Gasteropodous Mollusca and the supposed Aquiferous Apparatus of the Lamellibranchiata." By M. H. Lacaze Duthiers.

A memoir upon the aquiferous system and the oviducts of Lamellibranchiate Mollusks by Messrs. Rolleston and Robertson, was read before the Royal Society at the Meeting on the 3rd of February, 1859. The abstract of this memoir, contained in the 'Annals and Magazine of Natural History,' reached me in the month of July; and I was not a little surprised to find that a structure which I had so elaborately studied in the course of my various journeys to the sea-shore, and which I had carefully described in a number of species, was something quite different from what I had imagined it to be. Without entering into minute anatomical details, which would not tend to elucidate the question, I find that Messrs. Rolleston and Robertson consider that the organs, the ducts, and the orifices supposed to be the ovaries or their excretory ducts, are, in fact, nothing but an aquiferous apparatus, and that the openings placed on each side of the foot are the excretory orifices of this system. They discover elsewhere the ducts whose office is to convey away the products of the genital glands. The enunciation of an opinion so opposed to what I, in common with many other authors, had maintained, seemed to require a recurrence to direct observation. But on repeating my examination of

Cardium edule, *Tellina solidula*, *Mactra stultorum*, and *Donax anatina*, I have precisely verified my previous conclusions.

On throwing injections into the genital orifices, the sexual glands have become turgid; and on examining fragments of such injected genital glands microscopically, the injected substance was seen mixed with the ova or spermatozoa. These facts may be observed with especial ease in *Cardium edule*.

In addition to this, I have seen ova actually laid by living females of *Modiolæ* and *Mytili*, one of the valves of whose shell was removed, on irritation of the genital orifice; and in others the ova or the spermatic fluid may be made to pass out of their orifices, at the breeding season, by pressing gently upon the foot.

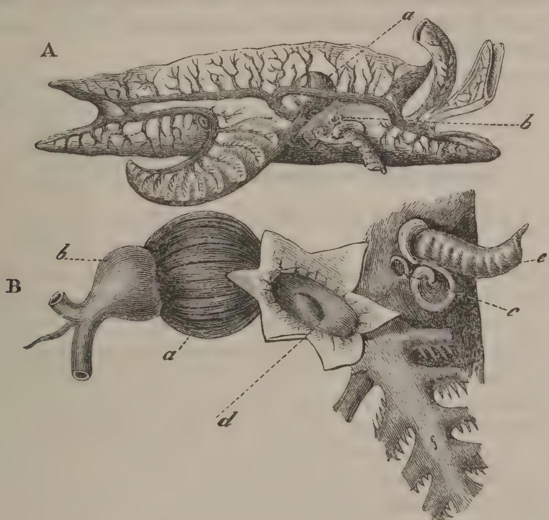
In *Spondylus gæderopus* the genital orifice is situated in the sac of Bojanus, and I had great difficulty in finding it when investigating this subject. It was, in fact, only by chance that I opened the sac of Bojanus and observed a little rose-coloured cylinder issuing from an orifice in its interior. This cylinder, like a thread of vermicelli in aspect, was composed of reddish ova mixed with mucus, and agglomerated. I might multiply examples; but it seems to be useless to do so, for I should simply reproduce the facts which I have brought forward in the memoir which I published in the 'Annales des Sciences Naturelles,' on my return from a long stay in the Balearic isles.

In this memoir, besides, I have not merely drawn attention to the circumstance that after oviposition the aspect of the gland changes completely, which might lead an observer to mistake the apparatus of reproduction for something quite different, but I have given figures of this condition of *Pecten varius*, &c. In fine, I believe that the structure of the male and female organs of the Lamellibranchiate Mollusca is such as it was described to be before the observations of Messrs. Rolleston and Robertson.

But does the system of aquiferous vessels, whose occurrence in the Mollusca has been sometimes admitted, sometimes denied, really exist in the Acephala? In the abstract to which I refer, those citations, which doubtless existed in the memoir, have not, and probably could not have appeared. It is well known that the belief in this supposed aquiferous system has been gradually becoming weaker. The necessity of explaining the extreme dilatation and contraction of the bodies of molluscous animals led anatomists to seek for and describe such a system; but at present the explanation of these facts is found in the direct mixture of water with the blood, or the ejection of the latter liquid. MM. Leuckart and Gegenbaur have made observations tending to prove the occurrence of this process in the Pteropods; M. Langer of Vienna has published a special memoir on the circulation of *Anodon*, and the great point he makes out is the passage of water into the blood by the intermediation of the organ of Bojanus. I believe that I have demonstrated in *Dentalium* the orifices by which the direct communication of the circulatory apparatus with the exterior of the body takes place; and lastly, I have found a Gasteropod,

and one which assuredly occupies a very high place in that group, which presents the same arrangement.

I hope to be able before long to bring out a complete Monograph of the anatomy of *Pleurobranchus aurantiacus*, in which the existence of an external orifice of the circulatory apparatus shall be put beyond doubt. As the figure which accompanies this Note shows, a very small orifice (*b*, fig. A, and *c*, fig. B) with a raised rim is visible above the external genital organs and in front of the principal branchial vein. This orifice, hidden by the contractions of the body, is very conspicuous in the dead animal. On injecting milk or any other liquid by it, the fluid is seen always to enter the heart; and on slitting up the branchial vein, there is seen within it an aperture (*d*, fig. B) leading into a little canal which is connected with the external aperture, and is the channel whereby the fluid injected enters the heart. I have varied the method of injection in every possible way, and always with the same result. I cannot conceive that there is any rupture of the parts or any extravasation of the



EXPLANATION OF THE FIGURES.

A. *Pleurobranchus aurantiacus*, seen in a side view.
- *a*. Heart.
- *b*. External orifice of the sanguiferous system, placed before the branchiæ and above the genital organ.

B. Enlarged view of the heart, branchial vein, &c.
- *a*. Auricle.
- *b*. Ventricle.
- *c*. External opening through which fluid may be injected into the heart.
- *d*. Branchial vein laid open at this part to show the internal opening of the canal which leads from the external orifice *c*.
- *e*. Penis.
- *f*. Part of the branchial vein, unopened.

injection, so that I believe (as may be verified in spirit specimens) that in the *Pleurobranchus* the circulatory apparatus communicates directly with the exterior.

The demonstration of a direct communication between the exterior and the circulatory apparatus, renders the assumed existence of an aquiferous system *a priori* less necessary, in order to explain the great changes of volume of the body of Mollusks. But I believe that, in addition, microscopic examination will show the direct continuity of the genital glands with the lateral orifices placed at the base of the foot in the Lamellibranchiata.

This communication of the vascular apparatus with the external water, has a very important bearing on the history of the nutritive processes. The physiological conceptions derived from the study of the higher animals are singularly affected by finding creatures which can at will throw out a portion of their blood, or, on the contrary, dilute with water that which is, *par excellence,* the nutritious element.

This would be sufficient to prove, were it necessary to do so, how wide is the difference between the vital processes of the lower and of the higher animals.

MISCELLANEOUS.

On the Hydra rubra *of* Mr. Lewes. By the Rev. W. Houghton, M.A., F.L.S.

To the Editors of the Annals of Natural History.

Solihull, Feb. 10, 1860.

Gentlemen,—In your January Number, Mr. G. H. Lewes records the discovery, on Wimbledon Common, of what he terms a new species of *Hydra.* His description of the animal is, that it is "a beautiful bright-red species, differing in intensity of colour in different states of the animal, being sometimes of a brick-dust hue." Van der Hoeven, Mr. Lewes says, enumerates *three* species of *Hydra,* which he calls *H. viridis, H. fusca,* and *H. grisea* respectively. Now, the authors of the 'Micrographic Dictionary' mention *four* species, namely, *H. viridis, H. fusca, H. attenuata,* and *H. vulgaris.* Dr. Landsborough, also, in his little book, 'The History of British Zoophytes,' describes these same four species, with the addition of *Hydra oligactis* (Baker). The description Dr. Landsborough gives of *H. vulgaris* (for it is to this species I wish to direct attention) is that it is about the same size as *H. viridis,* but that it differs from it in colour, "being of an orange-colour, or sometimes of a brown, or even *red tint.*" Under the word "Hydra," in the 'Micrographic Dictionary,' I read the following description of *H. vulgaris*: "Body orange-brown, yellowish, or *red.*" How does this differ from Mr. Lewes's so-called new species?

Why this animal has ever been designated as *H. vulgaris* I am at a loss to conceive. I have searched pools and ditches innumerable for *Hydræ*; and my experience tends to show that this species

is by no means "*common,*" for I have found it only in four or five localities.

The last time I made acquaintance with this *red species* (be its name what it may, but *vulgaris* suits it as far as description is concerned) was at Bala Lake, in the month of June last; and there it was in great profusion,—indeed, the only species I saw. It was found attached to the under surface of stones near the margin of the lake, and reminded me at the time very forcibly of the red *Dianthi*, to which Mr. Lewes also compares it. It was associated with *Fredericella sultana*, and with another (very rare) Polyzoon, *Plumatella punctata*.

But what is Van der Hoeven's *Hydra grisea*? Is it the same as the brown variety of *vulgaris*? Has it any synonyms? Whose is *H. vulgaris*? Certainly here in Warwickshire it is a misnomer, being the very opposite of common; indeed, I do not remember ever to have seen it in this neighbourhood. I have occasionally found it in Shropshire, and always in very clear, pure water.

H. fusca is more abundant here than even *H. viridis*.

I remain, Gentlemen, Yours, &c.,

W. Houghton.

[Dr. Johnston in the 2nd Edition of his 'British Zoophytes' describes four species: *H. viridis*, *H. vulgaris*, *H. attenuata*, and *H. oligactis*. The *H. grisea* of Van der Hoeven is probably the *H. grisea* of Linnæus, which is given as a synonym of *H. vulgaris*, Pallas.—Ed.]

On the Genus Hyalonema. By Dr. J. E. Gray, F.R.S. &c.

In my original description of the genus *Hyalonema*, published in the 'Proceedings of the Zoological Society' for 1853, p. 63, the publication of which I had delayed in hopes of being enabled, by the acquisition of more copious materials, to clear up some points which did not appear at that time capable of satisfactory elucidation, I described the "*Polypus ignotus*," but placed it near *Gorgonia*, on account of its being covered with bark, like the Barked Corals; and, in a recent paper in the 'Annals,' I suggested its being considered as a peculiar suborder of that class of Zoophytes.

Mr. John J. Brandt has lately published a description and figure of the animal, and shows that, instead of having eight pinnated tentacles, like the *Gorgoniadæ*, it has twenty or more simple conical ones, like the *Actiniæ*. Mr. Brandt proposes to form for its reception a peculiar family of the "*Polyactinia*," under the name of *Hyalochætides*. The figure of the animal and the structure of its external coat, and especially of the aperture of the cells, greatly resemble those of the genera *Corticifera* and *Mammillifera* and the other "*Zoanthaires coriaces*" of Blainville, indeed, one is now astonished that we had not before observed the similarity, and placed it with those animals. But the genus (or family) differs from these animals in having an erect axis, formed of a bundle of twisted silicious filaments.

Mr. Brandt received a specimen from Japan, which had been used as an ornament, in which nine specimens of this coral are grouped together in the hole formed by a *Pholas* in a soft rock. He figures this specimen; but I am convinced that this is not the way in which the Coral is naturally produced, and that they must have been artificially inserted into this perforation in the rock by the Japanese.

Mr. Reeves' specimen, which I first described, is the only one which has yet been described as imbedded in what I believe to be its proper habitat—a peculiar kind of Sponge; and I am confirmed in this opinion by the very intimate manner in which the Sponge is attached to the Coral in the above specimen.

Mr. Brandt figures two specimens to which more or less large portions of Sponges are attached, and he considers these Sponges to belong to the species which he calls *Spongia spinicrucis* and *Spongia octancyræ*, t. 1. f. 3, 4 & 5.

Mr. Brandt divides his specimens into two genera: 1. *Hyalonema*, of which he describes two species, *H. Sieboldii* and *H. affinis*; 2. *Hyalochæta*, containing a single species, *H. Possieti*; but I must say, from the variation in the several specimens of this Coral which have come under my examination, I am very doubtful if they are more than varieties of the same kind: at any rate, we want much more material before I could admit them to be distinct. The genera appear to differ only in the elongation and non-elongation of the cells, which will doubtless vary according to the manner in which the specimen is preserved.

On the Generative Organs of the Scarabæideous Beetles. By C. Roussel.

In all the *Scarabæidæ* the testes are formed of spherical, but more or less depressed capsules. A single genus is known to furnish an exception to this,—namely *Onthophagus*, in which they are conical. Their number, which varies sometimes, even in nearly allied groups, is never above twelve or below six in each testis; the latter number is by far the most frequent. They are usually more numerous in the *Cetoninæ*, and in this tribe their mode of insertion likewise presents a peculiar character: the cords which support these capsules usually arise from each other, instead of having a distinct origin.

The form and structure of the penis clearly separates the *Geotrupinæ* and *Coprinæ* from the rest of the family. In the former of these tribes it is short, straight, broad, and thick, and appears at the first glance to be composed only of a single, entirely horny piece. But of the two joints which compose this organ in all the *Scarabæidæ* there is only a vestige of the superior one, whilst the inferior piece has been developed at the expense of the abortive one. In the *Coprinæ* the two joints are nearly of the same size, but the upper one presents a characteristic border near the top. The position which it affects furnishes another means of distinction. In the other tribes it is directed from left to right, whilst in this it is always from right to left.

Beyond these two groups the penis presents a very remarkable

variability, not only between the divisions of a tribe, but sometimes even between the representatives of the same genus. The different species of Cockchafers and *Cetoniæ* furnish curious examples of this fact, which is still more striking in the *Anomalæ*. It is only between the most nearly allied species that we meet with a nearly complete similarity in the form of the organ of intromission. It would appear that Nature has taken the most minute care to prevent the mixture of types, and that crossing is practicable only within very restricted limits.

The female organs consist normally of two identical ovaries, formed of a number of sheaths corresponding exactly in each individual with that of the testicular capsules. These sheaths are united with each other and supported by a suspensory cord. There is also a more or less developed copulatory sac and some accessory glands.

The *Coprinæ*, from which the *Aphodii* must be separated, present a very remarkable character,—namely, the occurrence, well known in Birds, of the abortion of the ovaries of the right side. That which exists, even, is reduced to a single sheath of considerable length. At its base there are several small vesicular appendages, the vestiges of the aborted sheaths.

In the *Geotrupinæ* there is no apparent copulatory sac. The reservoirs destined to contain the seminal fluid of the male, which indeed are very small, are concealed beneath the muscular envelope of the base of the oviduct. In the *Cetoninæ* the sheaths are very short, and, as a consequence of this modification, the suspensory cord disappears.

In the *Glaphyrinæ*, *Melolonthinæ*, *Rutelinæ*, and *Scarabæinæ* neither the male nor the female generative organs present any marked differences.

From his investigations the author draws the following conclusions:—

1. There is always an almost exact similarity between the very nearly allied species of the same genus. This furnishes evidence in support of the happy definition of a genus given by M. Flourens.

2. Between two genera there are important modifications well adapted to characterize them.

3. These modifications, becoming more considerable in the representatives of higher groups, such as tribes, furnish valuable indications for zoologists.

4. The differences observed between the *Glaphyrinæ*, *Melolonthinæ*, *Rutilinæ*, and *Scarabæinæ*, which are admitted as tribes, are not comparable in value to those which distinguish the *Cetoninæ*, and still less to those which separate the *Geotrupinæ* and *Coprinæ*.

5. In the case of types of which the natural relations could not be appreciated with certainty by the consideration either of the external characters or of certain internal organs, the knowledge of the generative apparatus allows their position to be more accurately determined. Of this the comparison of the *Arthrophagi* and *Aphodii* furnishes a striking example.—*Comptes Rendus*, January 16, 1860, p. 158.

Description of a new Species of Gull (Gavia roseiventris) *from the Falkland Islands.* By J. Gould, Esq.

I describe this Gull as new, with a degree of hesitation, since it is hardly to be supposed that a bird of this magnitude, and doubtless, like the other members of the group, of very wandering habits, should not have been noticed and described. Still I can find no description which answers to this somewhat anomalous bird; neither does it accord with any of the numerous species contained in our national Museum. I make use of the word anomalous, because, although I cannot separate it from the little group of Gulls, of which our well-known species *Gavia ridibunda* forms a part, it differs from them in several particulars. In the first place, the specimen, which is certainly fully adult, has a nearly white head, the hinder part only being clouded with dusky, inducing the belief that a black hood was its characteristic at another season; yet, strange to say, the bill, legs, and feet are of the most intense coral-red; moreover these organs are very thick and fleshy, much more so than is ever seen in *G. ridibunda* and its allies; the gape, also, is wider than in the other members of the group, while the bill and tarsi are shorter; the hind toes of this, the only specimen I have seen, are well developed, but are entirely *destitute of nails* (probably from accident or injury); and lastly, the neck and breast are suffused with a beautiful pinkish rose-colour—a colour, which in spite of every care, disappears after a time, and which has sensibly diminished during the two months it has been under my notice; the three first primaries have their terminal portions entirely white, and the tail also is white, in which respects it agrees with the Black-headed Gulls in the British Museum, said to be from the Falkland Islands and the Straits of Magellan.

The following is an accurate description of this Gull:—

Tail, head, neck, and all the under surface white, suffused on the breast and abdomen with rich pinkish rose-colour; back of the head clouded with dusky; back and wings silvery-grey; primaries white, the first narrowly edged on the base of the external web, and broadly marked on the base of the internal web, with black, the remainder broadly margined on the internal web with black nearly to the tip; tail white; bill, legs, and feet coral-red.

Total length 13 inches, bill $1\frac{3}{4}$, wing $11\frac{1}{4}$, tail $3\frac{1}{2}$, tarsi $1\frac{5}{8}$.

Ground-colour of the egg light olive, elegantly variegated with irregularly-shaped markings of umber-brown, disposed in a zone near the larger end, and continued more sparingly over the whole surface, some of them appearing as if beneath the surface of the shell: these markings assume various V-shaped, arrow-headed, tail-shaped, and other fantastic forms. A lengthened and very pretty egg. Length 2 inches; breadth $1\frac{3}{8}$.—*Proc. Zool. Soc.* Feb 8, 1859.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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 28. APRIL 1860.

XXV.—*On the* Mycetozoa.

By Dr. A. de Bary, Professor of Botany in Freiburg*.

[With a Plate.]

The object of this memoir is to describe a group of organisms hitherto placed in the family of Fungi known as Myxomycetes or Myxogastres, and to prove them close allies of the Rhizopoda, and therefore members of the animal kingdom. Assuming this relationship to be proved, the author proposes to designate the group Mycetozoa, and proceeds to a sketch of the present state of knowledge respecting the undoubted Fungi, preparatory to instituting a comparison between their process of development and that of the so-named Mycetozoa.

The recent elucidation of the vital economy of the Fungi—the fact that they take up as food organic matter, either in a still living state or in the process of decomposition, and that they are destitute of chlorophyll and the characteristic colouring matter of plant—affords sufficient evidence that this class of organisms, so rich in forms, differs widely from all other Thallophytes. An examination of their histological characters will still further display the difference observable.

The thallus of all Fungi is composed of the so-called Fungi-fibres or hyphæ, which are elongated filiform and cylindrical, mostly branched, unicellular sacs; or in most instances filiform branched rows of at first cylindrical cells, subsequently often of very various figure (Pl. VI. fig. 7). The longitudinal growth of these fibres, so far as relates to new cell-formation, takes place exclusively or principally by transverse fission of the terminal cell of the fibre, and the construction thereupon of a new ter-

* Translated, in abstract, from the 'Zeitschrift für Wissenschaftliche Zoologie,' Band 10, 1859, p. 88, by J. T. Arlidge, A.B., M.B. (Lond.).

minal cell and of an additional member or joint to the series or row, which may be called the "segment-cell" ("Gliederzelle"). In the latter, fission either does not recur at all, or speedily comes to an end. On the other hand, the "segment-cells" shoot forth lateral saccular buds which, by the subsequent development of septa, constitute twigs or branches upon the primitive cell. All the septa in a branch are disposed one above the other in parallel order.

The thallus of the simple varieties of Fungi (the filiform Fungi or "moulds") is composed of hyphæ disconnected, or at most only approximated, in the act of growing. Fungi of a higher grade of development, which attain a spongy consistence, are formed of the same sort of fibres intertwined. The growth of such Fungi in breadth and thickness, apart from the simple expansion of the existing cells, is dependent on the formation of new histological elements, and proceeds from the development of offshoots to the contiguous hyphæ which are interposed between the original portions of tissue, or are overlaid upon the surface of the organism.

Indeed in the case of the seemingly more complex tissues of many Fungi—for example, of the external layer of many Agarici (*Russula*), the bodies of many Pyrenomycetes, the skin of the warty species of *Lycoperdon*, &c.—there is a near resemblance to the parenchyma of higher organisms in the appearance of juxtaposed globular or polyhedral cells, when a thin section is submitted to examination. In fact, however, the study of the development of such tissues proves that they likewise originate in the interlacing of hyphæ, and that their exceptional appearance is due to a subsequent expansion and displacement of the segments of the filiform fibres.

The construction and growth of Fungi therefore characterize them from all other Cryptogamia, such as the Fucaceæ and Florideæ, which exhibit the cellular structure and cell-development of higher plants. It is only in the formation of the reproductive organs that cells and cell-corpuscles are concerned in any of the Fungi. Nevertheless, the whole history of the organisms leaves no doubt of the vegetable nature of the true Fungi.

The systematic position of the entire class, as determined by affinity of structure, is in connexion with *Peronospora, Syzygites*, in the family Siphonæa, of which the best-known example is furnished by the genus *Vaucheria*. Indeed, the Fungi are so intimately allied to this family through the group of Saprolegniæ (e. g. *Saprolegnia ferax, Achlya prolifera*), that the latter might with almost equal reason be referred to the Fungi. Like these, the Saprolegniæ grow on diseased and dead organisms, and are

deficient of colouring matter in their cells; but, like the Siphonæa, they are inhabitants of water, and, what is more, they possess zoospores, which have never yet been discovered with certainty in any Fungi.

In structure and development the Fungi are closely related to the Lichens. The only appreciable difference between them is, that the hyphæ composing the thallus of the latter are separated by a distinct layer ("gonidial layer") of chlorophyll-bearing cells, probably concerned in the process of reproduction. In the matter of fructification there is an exact similarity between the Lichens and a large group of Fungi, and lastly, these two classes of organisms approach likewise generally in the mode of nutrition. In short, so intimate are the relations between the two, that Berkeley and others have proposed to unite them as two orders in one class.

The Fungi, as a definite class of organisms, agreeing among themselves in habits of life, in histological elements and in the phænomena of development, are separable from certain structures commonly referred to them on account of the similarity in their habits and mode of nourishment, represented by the greater portion of the Mycophyceæ. Among these pseudo-Fungi are the moulds or mildews that form on decomposing substances, the relations of some of which are readily determinable, whilst others are only incompletely developed phases in the cycle of development of true species of Fungi.

The formation of the spores of Fungi proceeds in a threefold manner: 1. The spores are produced, singly or several together, by the division of the terminal or twig-cell of the hyphæ (the basidia); or, 2. such cells swell into vesicular sacs (asci), from the contents of which the spores are developed by free-cell formation; or, 3. one of the cells, usually the terminal, divides into two or many spores, which become secondary cells (daughter-cells). More complex methods of fructification occur in the basidia of *Tremella,* and in the spore-cysts (sporothecæ) of *Eurotium, Erysiphe,* as the result of a combination of two of the three primitive types.

Sexual development is not yet demonstrated, although rendered not improbable by the researches of Ehrenberg on the conjugation of *Syzygites.*

The systematic distribution of the Fungi has hitherto been founded primarily upon their modes of development, and in a secondary degree upon the disposition and structure of the spore-cells. But, as Tulasne has latterly proved, one and the same species may exhibit the several modes of fructification. At the same time, it must be granted that the actual state of

knowledge of the Fungi is insufficient for the construction of a natural classification to replace the artificial one alluded to.

The two groups or orders of Fungi more immediately falling under notice in this memoir are:—

1. *Ascomycetes,* having dilated saccular sporothecæ (asci), wherein the spores originate by the free genesis of cells: *e. g.* Tuberacei (Truffles), Pyrenomycetes and Discomycetes, to which the Lichens are most nearly allied.

2. *Basidiospori,* producing spores from parent-cells (basidia). The free extremity of the basidium produces offshoots which acquire the form and dimensions of spores, and drop off, after the development of a dissepiment. Mostly four spores are formed and detached from a basidium simultaneously: one, two, or six are rarely produced. The basidia are congregated together in large numbers as spore-strata, or hymenia, lying parallel one above another and at right angles to the fibres from which they spring.

The *Basidiospori* form two principal sections: 1. Hymenomycetes, in which the whole of the hymenium, or only certain definite portions of it, occupies the free surface of the Fungus,—as, for example, in *Agaricus, Hydnum, Boletus, Polyporus, Clavaria.* 2. Gasteromycetes, in which the hymenium is lodged within a definite cavity (the *peridium*) in the substance of the Fungus, which opens when the spores are ripe, to permit their escape: to this division belong *Lycoperdon, Bovista, Geaster, Cyathus,* and many others belonging to the groups Hymenogastrei, Nidulariacei, and Lycoperdacei.

In many Gasteromycetes (such as *Lycoperdon, Bovista, Geaster*) having large peridia, these cavities contain, when ripe, the powdery spores mixed with more or less dry furfuraceous matter, and a hair-like mass, the "capillitium" (fig. 3). The peridium itself is, when in the same mature condition, a dry membrane of variable thickness, and sometimes divisible into several laminæ.

When, however, the spores are in course of development, these Fungi are fleshy, spongy, and imbued with much moisture: the cavity of the peridium is at the same time perceived to be divided into countless microscopic cells, separated by lamellæ from the anastomosing cavities of the network of the surrounding tissue. The inner wall of each cell or chamber is covered by a layer of spore-bearing basidia. The spores soon detach themselves from their supporting basidia, which, together with a portion of the tissue upon which they rest, become, during the ripening of the spores, dissolved and absorbed. During these changes, the fibres of the lamellæ, after the evaporation of the watery contents, become dry and produce the capillitium of the mature Fungus. Thus all the various struc-

tures met with in the ripe Gasteromycetes are explicable as products of the development of true basidiospores.

The sporothecæ of the Mycetozoa present to the naked eye a close resemblance to the ripe peridia of the Gasteromycetæ; and the similarity between the two groups is rendered greater by the circumstance that their habits are alike, and that they are both particularly common in decomposing vegetable infusions. Indeed they are only satisfactorily distinguishable on a comparison of their early development.

The author's next task is to minutely examine the structure of the genera of Mycetozoa or Myxogastres, among which are, *Physarum*, *Didymium*, *Diderma*, *Æthalium*, *Spumaria*, *Stemonitis*, *Diachæa*, *Licea*, *Arcyria*, *Trichia*, and *Lycogala*.

The earlier stages of development of the Mycetozoa which result in the formation of the sporothecæ, externally so like those of the Fungi, have hitherto been very partially investigated. The youngest condition recognized was in the form of a mucor or mould, interspersed with countless specks, which either constituted a formless, often thick, film on the substratum, or took the definite figure of pediculate drops, or formed a network of anastomosing veins over its surface (fig. 18). The mucor is usually white or yellow, seldom of any other colour. A peculiar kind of sporothecæ was often seen to form, under the eye of the observer, with astonishing rapidity, gradually hardening, and assuming the structure, consistence, and colour of such organs.

De Bary has more minutely examined these phænomena, at first in *Æthalium septicum*, and subsequently in other species. On detaching a portion of the surface of *Æthalium* where fructification is proceeding, it is found to consist superficially of a shining yellow substance of a mucoid consistence, tremulous, and reduced by slight pressure to a homogeneous pulp. Yet, when intact, it is not formless. Its surface is then seen to be overspread with a multitude of obtuse processes or papillæ, grouped in bunches, either erect or twisted together, and which seem to coalesce by their bases in the subjacent mass. The whole bears a general resemblance to a stem of coral, or to a piece of *Clavaria flava* (fig. 18).

On immersing a portion of this yellow mucor in alcohol, it becomes so hardened that it may be cut into thin sections, when its substance can be shown to be a tissue composed of interlacing cords or fibres (fig. 16), which terminate on the surface by free extremities, and there constitute the ramose lappets and papillæ above described. This same structure may be detected in *Æthalium*-fronds a foot in circumference, and where the fructifying portion is as much as two inches in depth. In such the same yellow cords or fibres are found, with the like consistence; and

it may be observed that they are most numerous at the periphery of the circle. The cords vary from a few lines to an inch in length, and are mostly much ramified, and often exhibit irregularly disposed varicosities. Their thickness varies from that of a bristle above half a line in diameter to that of a filament invisible to the naked eye.

On bringing these cords, with or without any of the surrounding mass, under the microscope, in a little water, their form is, after one or two hours, seen to change. They generally increase in breadth at the sacrifice of their length; and their twigs either change in figure, or new ones are produced. Further, the whole surface becomes by degrees covered with small, obtuse, wartlike prominences, which give it, to the naked eye, a granular aspect (fig. 17). These prominences extend themselves progressively into filiform cords, which soon overspread the surface in the form of an anastomosing network; and ere long it may be observed that these reticulated fibres change in figure, and give off new twigs, and produce new anastomoses, whilst others vanish (fig. 18). In this manner the whole fragment under notice changes its place; but this result is not observable until after it has remained under notice from four to twelve hours.

The organic basis of the cords is the same material as the sarcode of Dujardin, or the so-called "*formless contractile substance*" of Ecker, and presents the characteristic contractility, the gradual changes of form, and the flowing motions seen in the bodies of Rhizopoda. The substance of these cords and sarcode likewise agree precisely in chemical composition and reaction, except in relation to carbonate of potash—an exception insufficient to establish a difference in chemical nature.

The sarcode-matter is rendered turbid by countless granules (figs. 14, 15), some having the form of minute colourless points, whilst others are of larger dimensions, globular, with a dark outline and refracting centre, like fat-particles, soluble in alcohol and ether, and producing a yellow colour. The granules are either uniformly diffused or collected in the centre, leaving a clear peripheral margin. Vacuoles are often, but not always, present in the interior, of various and changeable figure, filled with water, and without special walls.

The onward flowing movements and the production of pseudopodous processes are seen, in the cords of *Æthalium* placed in water, to resemble those of Rhizopoda, although the structures in question are comparatively of colossal dimensions (figs. 14, 15).

Two kinds of processes or twigs are distinguishable: one visible to the naked eye, always filled with granules; the other microscopic, produced as simple or ramified tubercles on the former, and variable and retractile (fig. 17). These latter corre-

spond in size and character to those of Amœbæ, whilst at the same time their relation to the larger variety of processes is shown by their sometimes increasing to a similar bulk.

The molecular currents in the interior of the processes proceed in the direction in which their enlargement is taking place, and the regular circulation visible round the periphery of the pseudopodia of Rhizopoda is not noticed. The stream of granules is the more rapid the nearer it is to the long axis of the mucous or sarcode cord.

The sarcode-mass is enveloped by a membrane, which, in the cords of *Æthalium,* is soft and mucoid. The addition of alcohol renders this integument more evident by shrivelling up the contained mass (fig. 16). It is so soft, that the pressure of the thin glass placed over a specimen under the microscope is sufficient to rupture it, and to cause the escape of the semifluid sarcode in globular drops, which then swim away freely through the surrounding water. At first these detached globules exhibit a variable outline, but soon assume a fixed spherical figure; and their substance frequently arranges itself into a clear peripheral and a central granular portion. Moreover, they often become internally hollowed out by vacuoles, and finally collapse, undergoing a change in colour from yellow to reddish brown. The "vesicular cells" described by Schacht in the substance of *Æthalium* were doubtless sarcode-globules of the above kind.

The movements and variations in form of the sarcode-cords, kept in water, are often so rapid that a sketch of a fragment by a camera lucida is rendered impossible. In other instances, however, they are so remarkably slow, that the object must be observed for some few minutes to distinguish them. The degree of rapidity evidently depends in part on the age of the specimen, but still more on the temperature of the surrounding medium.

The sporothecæ (fig. 4) of all the Mycetozoa are developed from similar sarcode-cords (mesentericæ) which present the same essential characters as those of *Æthalium* just described,—the only differences perceptible being in size, colour, and in the distribution of the colouring matter.

Passing by the author's fourth and fifth sections of his essay, devoted to the consideration of the development of sporothecæ, the maturation of spores and their structural characters, we will terminate our abstract by a *résumé* of the general results arrived at, as contained in the sixth and concluding section.

In all stages of their development and of spore-production, with the single exception of *Æthalium,* the Mycetozoa are cellular organisms. That the spores are perfect cells, a glance at them is sufficient to prove (figs. 1, 2, 7). In the Amœbiform stage, a nucleus and an investing membrane are distinguishable;

and were this indication of their cell-nature wanting, the well-determined fact of their production from undoubted cells would furnish evidence to the same effect. In the "swarmers" (figs. 6, 8, 19), indeed, no cell-wall, in the usual acceptation of the term, is present; but there is a nucleus, and they are to be regarded as primordial cells possessing the power of secreting a cell-wall, although for the time that power is held in abeyance. Lastly, the sarcode-cords must be considered as cells, notwithstanding their figure and size, inasmuch as they are derived from the Amœbiform existences, the peculiar properties of which they continue to retain. The same statement holds good of those cell-bodies derived from the coalescence of two or more originally independent cells; for they are in structure precisely similar to cells derived from the fructifying conjugation in Algæ, which proves that, in the strictest sense of the word, a cell may originate from the coalescence of two or more cells.

It must, however, not be concluded that the sarcode-cords originate in a coalescence of cells by a process of vegetative copulation: on this subject further inquiries are needed.

The only satisfactory criterion of an animal nature in a doubtful organism is to be found in the reception of solid food—a property not possessed by any plant or plant-cell. Assuming the correctness of this statement, the Mycetozoa are referable to the animal kingdom; for solid particles are found within their sarcode-substance, just as in the aquatic and undoubtedly animal Amœbæ. Not that the act of prehension has been witnessed; but the cells of Algæ and Fungi and the spores of Mycetozoa have been seen in the interior of the Amœbæ of *Trichia, Arcyria,* and *Æthalium.* In *Lycogala* alone have such foreign particles been hitherto sought in vain.

The evidence that these solid particles serve as food, and are not accidentally enveloped by the mucoid sarcode, as Dujardin affirmed, rests on the same basis in the case of the Amœbiform phases of the Mycetozoa as in that of the true Amœbæ; and even should their accidental entrance within the tissue be demonstrated, yet the Mycetozoa would claim a place in the animal kingdom on the ground of their many and great resemblances to admitted animals, and their slight analogy to any plants.

The connexion of Mycetozoa with Gasteromycetes must be severed, since it is founded only on superficial resemblances. They are most similar to the Algal groups of Siphonæa and Saprolegniæ; but, although the zoospores of these Algæ possess a certain degree of locomotive power and contractility, yet these properties are in them far inferior in intensity to those of the Mycetozoa, and are likewise of comparatively very brief duration.

Indeed the difference between the Mycetozoa and those beings nearest akin to them is very much wider than that between the cells of any other divisions of the vegetable kingdom; on the other hand, their structure, vital phænomena, and movements bear the closest resemblance to many animal organisms, and so much so to the Rhizopoda (figs. 9, 13) that their sarcode-fibres are all but indistinguishable from them except by their much greater magnitude.

Admitting therefore the Myxomycetes to be of an animal nature, and referable to the animal kingdom under the name of Mycetozoa, it yet remains questionable to what division of that kingdom they should be assigned. Naturalists have of late treated the Amœbæ as one division of the Rhizopoda, but this relationship must, in the case of the Amœbæ of the Mycetozoa, be looked upon as very doubtful, inasmuch as there is little in their developmental history in common with that of the testaceous Rhizopods. At present it would seem best to regard the Mycetozoa as a special order, agreeing on the one hand with the Rhizopods in the structure of their bodies and their variety of movements, and on the other, with the Gregarinæ by unmistakeable affinities in the whole cycle of development.

The next question that arises is: Are all the Amœbæ merely developmental phases of the Mycetozoa? or are only some such, and others similar phases of other animals? or have some an independent existence as species? Direct observations are wanting to determine these points; but this much is certain—that cells possessing the peculiar movements of Amœbæ occur as embryonic stages of higher or of lower animals, of unicellular and few-celled organisms. The Amœbiform cells which issue from *Psorospermia,* and are transformed into *Gregarina,* may be cited in illustration, as may be also the Amœba-moving organisms seen by Lieberkühn and Schenk to issue from the saccular cells found parasitic on the larvæ of insects and Crustacea. The Amœbæ of the Mycetozoa afford a third example.

Considering these facts to be indicative of the part played by Amœbæ in the cycle of development of other animal forms, in connexion with that of the failure of observers to distinguish any definite plan of development belonging to them as distinct animals, it appears highly probable that these beings generally have no claim to be regarded as independent existences or determinate species, but simply as developmental phases of other beings.

This being granted, there is still no sure proof that the aquatic Amœbæ belong to the developmental cycle of the Mycetozoa; nor, on the contrary, are there sufficient arguments against the hypothesis. There is no doubt that the aquatic Amœbæ agree

in all essential points with the Amœbiform beings which originate from the spores of Mycetozoa; further, a certain number of Amœbæ (e. g. *A. radiosa, A. verrucosa*) occur not only in freshwater ponds, but still oftener in places where Mycetozoa are abundant, as in the moist detritus about fallen leaves and mosses in woods, on decayed wood, and about Fungi, &c. It is moreover to be remembered that the Mycetozoa-spores readily germinate in water (figs. 1, 2, 8), and that in the wide distribution of the Mycetozoa, their many species, their multitudinous spores, the lightness of these, and the facility with which they may be scattered abroad and carried through the air, we have little difficulty in presuming the genetic connexion of the aquatic Amœbæ with them.

It is supposable that the aquatic Amœbæ may by their motile power leave the water for external conditions better adapted to their further development into Mycetozoa; or that, on the contrary, they may confine themselves preliminarily to a multiplicative process, or to encysting, and sink to the bottom when external conditions are unfavourable.

The foregoing reflections, therefore, render it probable, to say the least, that many aquatic Amœbæ are phases of being in the development of Mycetozoa. Others, which from their locality and their form differ very widely from the common type, such, for instance, as *Amœba porrecta* (Schultze), or such as *A. guttula* and *A. Limax,* which are remarkable by the absence of slender pointed pseudopodia, and by their movements, are, in all probability, generative phases of other animals, possibly of the testaceous Rhizopods. This reasoning on possibilities and probabilities needs, however, to be established by observation; and the author advances the foregoing researches only as guides to future inquirers.

EXPLANATION OF PLATE VI.

Fig. 1. Spores of *Stemonitis obtusata* placed in water: a, one such in which the contained "swarmer" is beginning to escape. Magnified 390 diameters.

Fig. 2. Two spores of the same organism: in b, the swarmer has almost escaped.

Fig. 3. A stalked spore-holder (*Sporenblase*) of *Physarum albipes,* divided longitudinally, and viewed on the cut surface. The dislodgment of the contained spores reveals the "columella" and "capillitium." Magn. 390 diams.

Fig. 4. A group of immature sporothecæ of *Physarum plumbeum.* A few of the sarcode-cords, from which the spore-holders originate, are seen in the form of fibres.

Fig. 5. "Swarmers," a to ζ, in various stages of self-fission. The vacuoles are seen in a state of diastole (expansion) in β, δ, and ζ; but are invisible in γ and ϵ, owing to their condition of systole or contraction. Magn. 390 diams.

Fig. 6. *a* to *d*, "Swarmers," swimming in water, assuming various figures of a Eugleniform character. Magn. 390 diams.
Figs. 7 and 7 *sp*. A portion of the capillitium of *Æthalium septicum*. At *b* is a collection of calcareous matter; *sp*. spores of the same. Magn. 390 diams.
Fig. 8. *a* to *e*. Spores of *Æthalium septicum*: *a* to *c*, escape of "swarmers" from their enclosing integument; *c'*, the swarmer immediately after its escape; *d*, *d'*, two swarmers furnished with two cilia; *e*, a third with one cilium only, as usual. Magn. 390 diams.
Fig. 9. A large Amœba of *Æthalium septicum*.
Figs. 10–13. Amœbæ of the same organism, of various sizes, exhibiting their progressive growth.
Fig. 14. A large Amœba of *Æthalium septicum*, crawling in the direction of the arrow shown alongside, and showing internally three large vacuoles, but no foreign ingesta. Length $\frac{1}{10}'''$; width $\frac{1}{24}'''$. Magn. 390 diams.
Fig. 15. An encysted Amœba of the same being, having seven spores of *Æthalium* within it, observed to rotate with the substance around them. Magn. 390 diams.
Fig. 16. A slightly magnified view of a section of the spore-producing portion of an old *Æthalium septicum*, after being treated with alcohol. The spore-producing sarcode-cords are swollen, and distinguished into a cortical and a medullary portion; much of the former, however, has been lost in making the section.
Fig. 17. A small segment of a magnified view of the sarcode-ramifications of *Æthalium septicum*, showing the secondary pseudopodous processes, *a*, on the margin. Magn. 90 diams.
Fig. 18. A portion of the network of sarcode-fibres of *Æthalium septicum*, expanded on a glass slide, and viewed by reflected light; of the natural size.
Fig. 19. *a* to *n*. Spores and their contained or emerged swarmers of *Trichia varia*. Some seem of a Eugleniform figure, with a filament; and others Amœbiform, with or without a filament.

XXVI.—*Notes on* Plectopylis, *a group of* Helicidæ *distinguished by several internal plicate Epiphragms; with the Characters of a new Species*. By W. H. Benson, Esq.

An examination of the interior of specimens of *Helix Achatina*, Gray, received from Moulmein, has revealed a singular and interesting internal structure in that shell. This formation occurs also in *H. Cyclaspis*, B.; the dextrorse variety of *H. refuga*, Gould, from the Tenasserim Valley; the species from the banks of the Irawadi (*H. Leiophis*, B), previously supposed to be a small variety of *refuga*; and in a second group from Darjiling and the Khasia Hills, consisting of *H. plectostoma* and *H. Pinacis*, B.

The longest-known shells of the group have been classed with various forms by systematic authors. *Helix Achatina* and *H. refuga* were referred by Albers to *Atopa*, which also includes the Cingalese *H. Rivolii*, Desh., and *H. erronea*, Albers, possess-

ing no true plicate barriers, and furnished with only a few lamellæ running longitudinally to a moderate distance within the aperture. Pfeiffer refers the whole of these shells to *Ophiogyra;* and Messrs. H. and A. Adams include them all in *Corilla,* as a section of *Anchistoma.* Again, *Helix plectostoma,* B., is referred by Albers to *Gonostoma,* synonymous with *Polygyra,* Say and Pfeiffer, and with *Polygyra* as a section of *Anchistoma,* H. & A. Adams. These include *Helix obvoluta, H. angigyra, H. Corcyrensis,* and other shells which exhibit no traces of pylaic plication. It therefore becomes necessary to separate the first division from *H. Rivolii* and its congeners, and the second from *H. obvoluta* and its allies. Together they will form a natural group divisible into three sections conformably with the varying structure of the plicate pylæ; and as the type of the first group was announced in a former paper as being ovoviviparous, there may exist grounds for generic separation from *Helix* equally strong with those which authorize the distinction of *Partula* from *Bulimus.* I name the group

Plectopylis.

Testa plerumque sinistrorsa, late umbilicata, subdiscoidea, depressa vel conoideo-depressa; apertura plica parietali callosa lamellam horizontalem sæpe emittente, intus pylis sive epiphragmatibus pluribus distantibus plicatis (prima ab apertura plus minusve remota) obstructa.

The typical section comprises species in which the pylaic epiphragms consist of a strong vertical parietal lamina, with a tortuous support on the inner side, and giving out towards the aperture various horizontal lamellæ, another independent horizontal plica crossing near its base; while the palatal portion consists of three horizontal plicæ above, one below, and a large transverse vertical lamina which corresponds with and crosses behind the outer portion of the dichotomous parietal lamina. It comprehends

Helix Achatina, Gray.
—— *Cyclaspis,* B.

The second section consists of species in which the parietal vertical lamina is more simple than in the first, being scarcely dichotomous, but provided with anterior lamellæ; while there are six long or short, straight or sinuous, horizontal palatal plicæ, the fifth of which in one species has a tendency to simulate the vertical lamina of the previous section, and some double plicæ in the other point towards the 3rd section. It comprehends

Helix refuga, Gould, var. *dextrorsa.*
—— *Leiophis,* B., n. s.

The 3rd section is distinguished by having the epiphragm near the aperture, and by a still more simple parietal lamina placed vertically, and with a separate horizontal plica below, as in the previous sections, but unfurnished with anterior lamellæ. The palatal plicæ are six in number, several are backed by a second more oblique row, and the vertical lamina present in the first section is deficient. It comprehends

Helix plectostoma, B.
—— *Pinacis*, B.

The pylaic plicæ may be distinctly viewed by filing across the last whorl, a little in front of the barrier, so as not to injure the palatal plicæ nor the aperture of the shell, care being taken first to ascertain the distance from the aperture by means of a flexible lamina of quill. The slit may be cautiously enlarged, according to circumstances, and the back of the epiphragm may be examined by a similar process beyond it.

The following characters require to be added to those hitherto recorded:—

1. *Helix Achatina*, Gray.

Janua pliciformi fauciali prima remota, lamina 1 parietali magna verticali bifurcata, postice sinuosa intrante, antice lamellas 2 emittente, mediana aperturam attingente, inferiore mediocri, plica 1 basali horizontali elongata; plicis palatalibus 3 superioribus, 1 basali intrantibus, lamina 1 verticali lata elongata intersita.

The pylæ or barriers are reproduced at certain distances in the interior whorls; and the more distant have only a short central lamella, occasionally obsolete, proceeding anteriorly from the parietal lamina, in addition to the basal plica.

Found at the Farm Caves near Moulmein.

2. *Helix Cyclaspis*, B.

(Annals Nat. Hist. March and April, 1859.)

Janua pliciformi fauciali prima remota, lamina 1 parietali magna obliqua subbifurcata, antice lamellam unicam inferiorem brevem emittente, plica 1 basali spirali; plicis 3 palatalibus superioribus fortibus elongatis sinuosis, 1 basali intrantibus, lamina 1 obliqua satis magna intersita.

In this shell the large parietal lamina is not so distinctly and widely double as in *H. Achatina*, and it gives off no medial anterior lamella to connect it with the shortened apertural lamella.

Mr. Theobald's single specimen was much worn. Examples in good condition, procured by Capt. J. C. Haughton at the

Farm Caves near Moulmein, enable me to add the characters of the sculpture and colour.

Testa — superne oblique rugoso-plicata, subtus læviore, umbilicum versus spiraliter striata, superne albida, castaneo-strigata et variegata, subtus fusco-castanea, umbilicum versus albida.

The lamella proceeding from the pylaic parietal plait and the second superior palatal lamina are both visible from the aperture.

3. *Helix Leiophis*, B., n. s.

Testa sinistrorsa, late et profunde umbilicata, subdiscoidea, superne planata, interdum omnino plana, vix solidula, oblique et arcuatim rugoso-striata, lineis nonnullis spiralibus decussata, sub epidermide scabra, fusco-cornea, albida; spiræ apice vix elevatiusculo lævigato, sutura impressa; anfractibus $5\frac{1}{2}$–$6\frac{1}{2}$ angustis, ultimo supra peripheriam angulato, antice valde deflexo, basi rotundata, apertura valde obliqua subhorizontali, lunari, peristomate reflexo albido, marginibus lamina sinuosa elevata, medio lamellam profunde intrantem, usque ad januam attingentem emittente junctis. Janua pliciformi fauciali prima remota; lamina 1 parietali verticali simplici forti lamellam aperturalem valde elongatam superne emittente, infra eam lamellis duabus brevibus (a lamina spatio brevi separatis) munita; plicis 6 palatalibus intrantibus, quinta robustiore obliqua.

Diam. major 11–14, minor 8–11, alt. 3–$4\frac{1}{2}$ mill.

Hab. ad Kwadouk, prope Thyet Mio.

Distinguished externally from the typical *H. refuga*, Gould, and its dextrorse variety by its narrower whorls, absence of angulation on the lower side of the last whorl, its more oblique and nearly horizontal aperture, and by the circumstance of no lower lamella being visible from the aperture, as in that variety*. Internally it is distinguished by the shortness and simplicity of the six palatal plaits, and by the obliquity of the fifth, which gives some token of an approach to the palatal lamina of the first section; also by possessing two short horizontal lamellæ, arising near but not touching the upright parietal lamina, in addition to the long lamella which connects that lamina with the aperture, as in *Helix Achatina*; whereas *H. refuga*, var. *dextrorsa* has but a single lengthened lamella proceeding from the lower part of the pylaic parietal plait, and the long apertural one is not connected with that plait, taking its rise close to it.

4. *Helix refuga*, Gould, var. *dextrorsa*.

Janua pliciformi fauciali prima remota; lamina 1 parietali magna

* The internal barrier of *H. refuga* requires examination, and may prove it to be distinct from the supposed dextrorse variety. In the typical shell the lower parietal lamella is said to be invisible from the aperture, and may be altogether wanting.

verticali simplici antice lamellam 1 inferiorem elongatiusculam emittente, lamella superiore valde elongata aperturæ laminam parietalem non omnino attingente, plica basali obsoleta; plicis palatalibus intrantibus 6, tribus superioribus et basali elongatis sinuosis, quarta et quinta brevibus, postice plicis obliquis distinctis munitis.

This form occurs at Phye-thán, in the Tenasserim Valley. It exhibits an approach to the next section in some of the palatal plaits.

5. *Helix plectostoma,* B.

Janua pliciformi fauciali prima minime profunda, ab apertura partim apparente; lamina 1 parietali verticali simplici, lamellis nullis munita, plica basali brevi; plicis sex palatalibus, superiore basalique simplicibus, secunda vix duplicata, tertia, quarta quintaque postice plica obliqua munitis.

This form inhabits Darjiling and the Khasia Hills.

6. *Helix Pinacis,* B.

(Annals Nat. Hist. April 1859, p. 268.)

Janua pliciformi fauciali prima profundiuscula, ab apertura vix apparente. Lamina et plica basali ut in specie antecedente, plica basali nonnunquam obsoleta; plicis sex palatalibus, prima et secunda supernis plus minusve simplicibus, tertia vix duplicata, quarta, quinta basalique duplicatis, hujus plica secunda ad latus concurrente, nec postica.

It differs from *H. plectostoma* in the formation of the chief palatal plaits, and in having a supplementary parallel basal fold.

This species is found rarely near Darjiling. A minute variety occurs among Mr. W. T. Blanford's specimens of *H. plectostoma,* $3\frac{1}{2}$ to $4\frac{1}{2}$ millimetres in the larger diameter.

There appears to be a regular gradation from *H. Achatina* to *H. Pinacis,* through *Cyclaspis, Leiophis, refuga,* and *plectostoma,* each species presenting peculiarities in the details of the pylaic plication.

Dr. L. Pfeiffer attributes only three palatal plates to *Helix erronea,* Albers. On filing into the shell behind the lamellæ, a fourth is found, as well as in *H. Rivolii,* Desh. The arrangement of the lamellæ differs in the two species.

On a close examination of the little Cingalese *Helix clathratula,* Pfr. (*H. Puteolus,* B.), a sparsely toothed lamellation becomes apparent internally: it is seen through the transparent lower side in two parallel lines, as many as six teeth occurring in a group; occasionally some are visible from the aperture. Pfeiffer refers this shell to *Patula.*

Cheltenham, March 1, 1860.

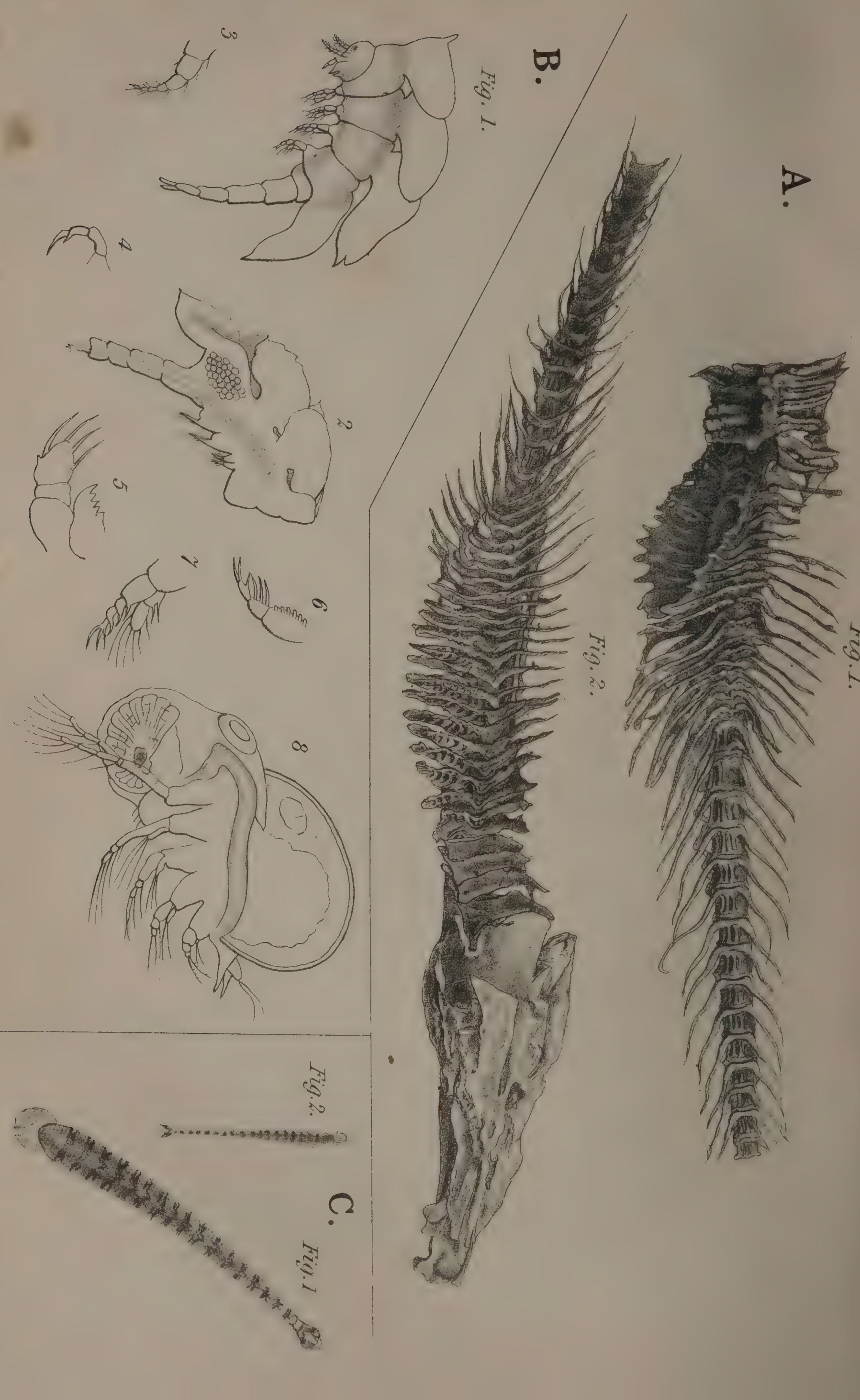
XXVII.—*On the Discovery of the Snail-Leech,* Glossiphonia marginata, *in England.* By the Rev. W. Houghton, M.A., F.L.S.

[With a Plate.]

To the Editors of the Annals of Natural History.

Gentlemen,

I have to record the occurrence of a species of *Glossiphonia* (Rawlins Johnson), viz. *G. marginata,* as an addition to our English fauna. This species has never before been found in any locality in England; under the name of *Hirudo flava,* however, Sir J. Dalyell seems to have met with it in Scotland (*vide* 'Power of the Creator Displayed,' vol. ii. pl. 5. figs. 1–19). His figures are not at all good; the characteristic form of the head, however, is sufficiently shown, which is described as being "lanceolate or trout-shaped." The description of *Hirudo flava* by Dalyell agrees with the characters of *Glossiphonia marginata,* with the exception of the number of eyes which his specimen possessed. *Hirudo flava* has only two eyes, whereas *Glossiphonia marginata* has four; but this discrepancy is easily accounted for when we remember that the number of eyes is not, in this family, by any means constant in all the individuals of any one species. Sometimes the anterior pair are very rudimentary, sometimes entirely absent. Moreover, in *G. marginata* the anterior pair are considerably smaller than the posterior pair, and might possibly be overlooked. Dalyell's description and drawings were made from specimens which he found during the time of their having either eggs or young adhering to the belly; and at this time *G. marginata* is, on the under side, of a bright yellow colour, as are also the ova. The specific name, however, of *flava* would give a very erroneous notion of the usual colour of this animal, though the name is appropriate enough during the breeding-season. However, I feel pretty certain that *Hirudo flava,* in spite of these discrepancies, is identical with *G. marginata,* and has therefore been discovered in Scotland; but I can find no record of its ever having been found in England. The first specimen of the species I ever saw was found by me in Bala Lake, on the 22nd of June last; it was attached (*more* Glossiphoniarum) to the under surface of a stone near the margin of the lake, with a number of yellow eggs underneath it. The only other locality in which I have found *G. marginata* is in a small stream in Warwickshire, on the Solihull and Barston road, on the right-hand side of the wooden foot-bridge about a mile from the latter village. Here, in the autumn of last year, I found some four or five specimens: the animal is, however, very rare. I have for the last two years confined my attention chiefly to the Glossiphons, and have searched many ponds for



J. Basire lith.

species, but have never found *G. marginata* except on these two occasions; indeed, in this very Barston Brook, I have turned over hundreds of stones, and not far from the spot where I had first seen them, but without success. The drawings which accompany this notice were done for me by my kind friend Mrs. Rumsey, of Solihull; the specimen, of which the illustration is a very faithful likeness, is still living in a glass vessel in my room. I refrain from making further remarks on this leech at present, as I hope by-and-by to offer some observations on this family, with a monograph of all the British species which form the family Glossiphonidæ.

Glossiphonia marginata. Plate XVI. C. figs. 1 & 2.

Body, when at rest, nearly elliptical, but narrowing towards the anterior extremity; capable of great elongation, when it assumes a linear form. Back, when arched, showing the rings very clearly; marked longitudinally with five regular rows of light-yellow dots, equidistant, and thinly sprinkled with smaller dots of the same colour, the central row alone extending nearly the whole length of the animal. Margins light-coloured and transparent, having at intervals two narrow dark-coloured parallel lines, which are at right angles to the axis of the body. Ground-colour of body claret. Oral sucker constricted at the base, subtriangular or lozenge-shaped, forming a well-defined head. Extremity on the upper surface almost transparent. Head with a light-claret-coloured patch on either side, giving it, if examined without the aid of a lens, a truncate appearance. Eyes four, arranged in two longitudinal series, converging anteriorly; the posterior pair much the largest. Posterior sucker very large, round, with about twelve distinct claret-coloured rings. Stomachal cæca seven pairs, with three smaller ones in front, the former bifurcate and nearly at right angles to the longitudinal axis of the body; the seventh pair immediately bending downwards and extending to the base of the posterior sucker. Colour of the cæca a deep green.

Length when at rest, about 6‴. Ditto, when extended, 1″. Breadth when at rest, 2‴.

Habitat. Bala Lake. Brook near Solihull, Warwickshire.

I remain, Gentlemen, Yours, &c.,

W. Houghton.

EXPLANATION OF PLATE XVI. C.

Fig. 1. *Glossiphonia marginata* extended (magnified).
Fig. 2. Ditto, natural size.

XXVIII.—*Description of new* Sertulariadæ *from the Californian Coast.* By Andrew Murray, F.R.S.E.*

[With two Plates.]

The interest which attaches to the existence of closely allied forms in far distant regions induces me to publish the following isolated descriptions of five new Sertulariadæ from the coast of California.

With one exception, they are all most nearly allied to species found on the British coasts, viz. to *Sertularia operculata, S. filicula, Plumularia falcata,* and *Plumularia cristata*; and I may notice that along with them I received the stems of a *Eudendrium* which I cannot distinguish from *Eu. ramosum* of our own coast, although, from the want of the vesicles, it is impossible to decide whether it is a distinct species or not.

To secure absolute accuracy in the figures, they have been drawn by the aid of the camera lucida.

1. *Sertularia tricuspidata*, Murr. Pl. XI. fig. 1.

Cells inversely pear-shaped and nearly opposite, a single one in the axilla of each pinna; mouth at end of cell, aperture obliquely truncate, tricuspid at the outer edge; middle cusp longest. *Vesicles unknown.*

The habit of this species is perfectly that of *S. operculata.* Its cells, however, are broader, shorter, stouter, and less acutely conical; they are not perfectly opposite; they do not meet each other at the base, and are more everted; they are tricuspid on the outer lip, the middle cusp being longest, and the lateral cusps are nearer it and more reflexed than is the case in *S. operculata* when it has two lateral teeth.

It grows in tufts from 2 to 3 inches high, flexuose and serrulated, with polype-cells which are fully as much everted as is usually the case in this family, instead of being less so, as is the habit of *S. operculata.*

There were no vesicles in my specimens.

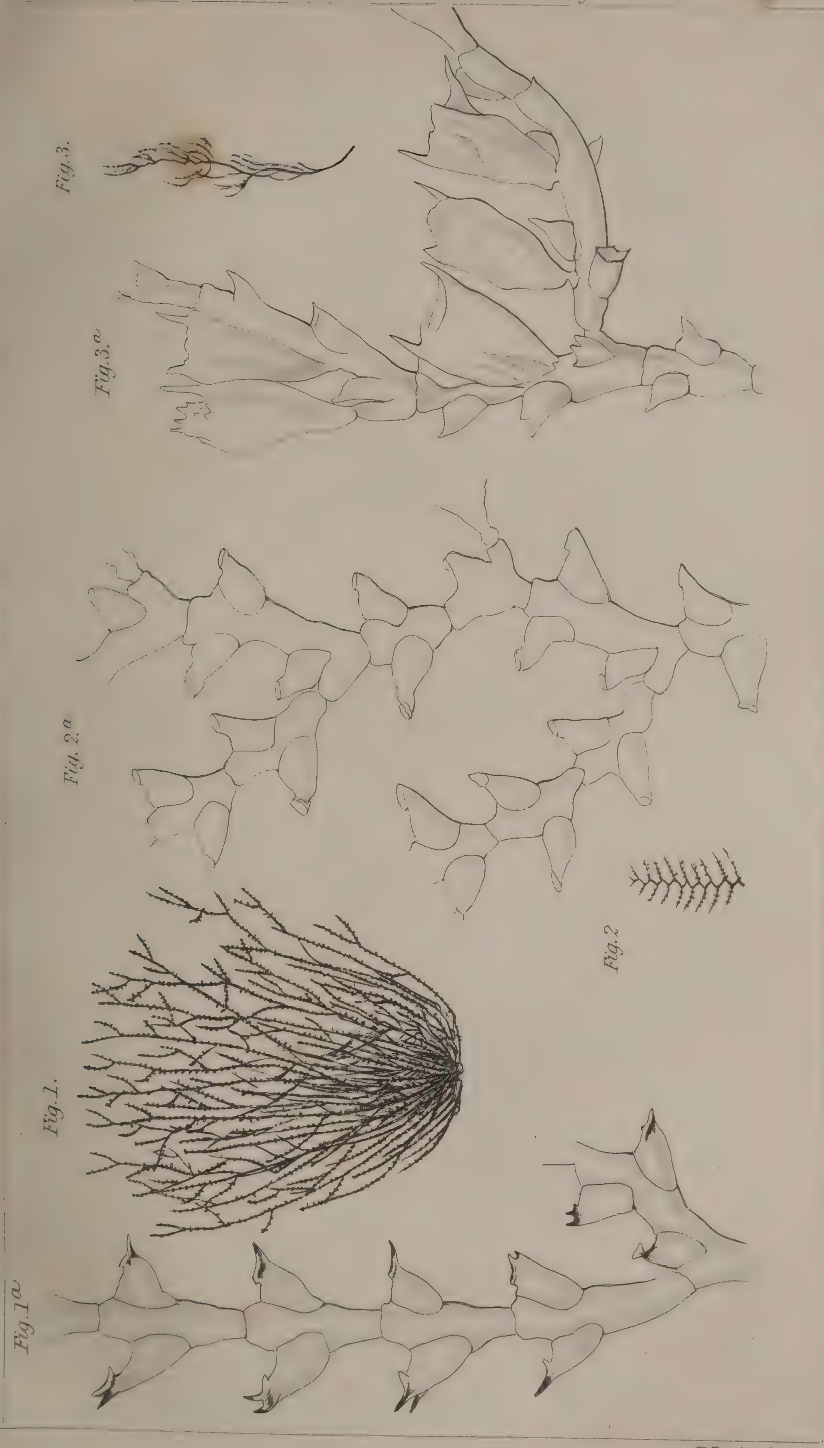
Bay of San Francisco.

2. *Sertularia labrata*, Murr. Pl. XI. fig. 2.

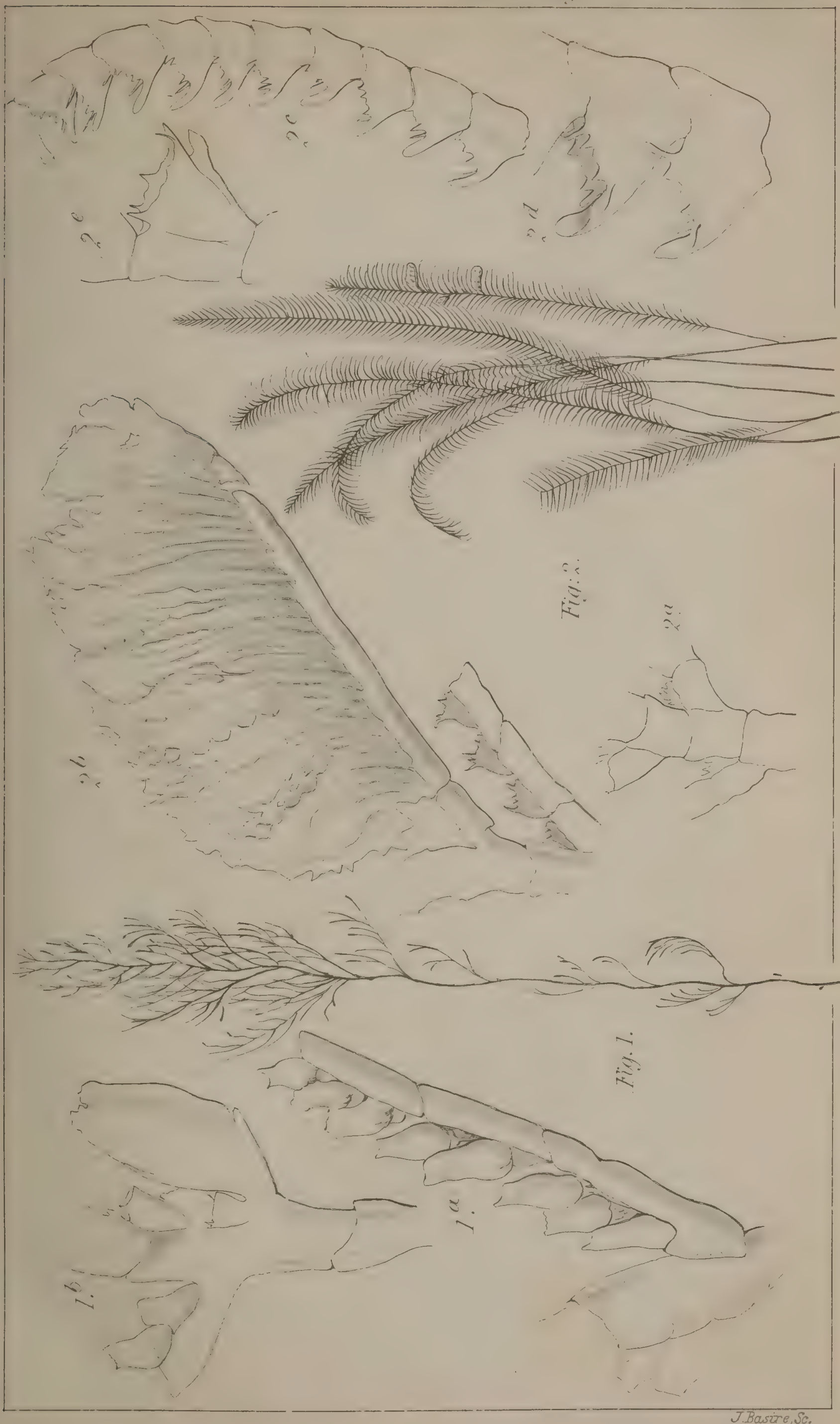
Cells nearly opposite, a single one in the axilla of each pinna; mouth at end of cell; lip distinct, not toothed; aperture obliquely truncate. Vesicles not known.

Like *S. filicula* in habit. The cells, however, are differently

* Communicated by the author, having been read before the Royal Physical Society of Edinburgh, Feb. 22, 1860.



J. Basire, Sc.



J. Basire, Sc.

shaped, more like those of the last species, but not toothed. The lip is distinct.

I have received only a minute portion, without vesicles.

Bay of San Francisco.

3. *Sertularia corniculata*, Murr. Pl. XI. fig. 3.

Cells not quite opposite, sometimes nearly alternate, forming an open cup resting on the stem; lip not distinct; exterior margin somewhat projecting at tip; a single one in the axilla of each pinna. Vesicles pear-shaped, with two long points projecting like horns at the thick end; aperture between them.

This is a very elegant little species, and is easily distinguished by the two long horns at the top of the vesicles, which remind one somewhat of a fool's-cap, and by the wholly open cells.

Bay of San Francisco.

4. *Plumularia gracilis*, Murr. Pl. XII. fig. 1.

Stem slightly flexuose, branched; branches alternately pinnated; cells ranked closely in twos and threes; tubulous, with a plain rim slightly peaked in front; vesicles oblong-oval.

The characters of this *Plumularia* do not differ greatly from those of *P. falcata*; but its habit is so different that it can scarcely be mistaken for it. The branches are closer, and more thickly set, than in *P. falcata*; their arched disposition is wanting; and the whole plant has more the aspect of a *Sertularia* than a *Plumularia*. The cells are proportionally larger than in *P. falcata*; instead of a plain truncate rim, it has one slightly peaked in front, or excised at the sides. Each cell has also a sort of support, like a triangular buttress, below it, marked or lined off from the cell itself.

Bay of San Francisco.

5. *Plumularia struthionides*, Murr. Pl. XII. fig. 2.

Shoots simple, plumous, the pinnæ alternate; cells close, each occupying the whole of one side of the joint to which it is attached, cup-shaped, with a toothed margin, of which the teeth are unequal, the one in front projecting much more than the rest; vesicles gibbous, girt with toothed ribs.

This species is nearly allied to *P. cristata*, but is much closer in habit, both the pinnæ and the cells being nearer each other. The cells are wider-mouthed and shallower. Besides the projecting process in front, there about ten teeth round the margin instead of eight, and they are unequal instead of being equal; the first two and the last two are long and slender, and the

whole are variable in size and development. The vesicles are considerably larger than in *P. cristata*, and the ribs are toothed.

When dry, this species, like *P. cristata*, becomes curved in a falcate manner, and the pinnæ are frequently laid to one side, so that it assumes a good deal of the form of an ostrich plume, in reference to which I have given it the above specific name.

Bay of San Francisco.

EXPLANATION OF THE PLATES.

Plate XI.

Fig. 1. *Sertularia tricuspidata*, natural size: *a*, portion of same, magnified.

Fig. 2. *Sertularia labrata*, nat. size: *a*, portion of same, magnified.

Fig. 3. *Sertularia corniculata*, nat. size: *a*, portion of same, magnified.

Plate XII.

Fig. 1. *Plumularia gracilis*, nat. size: *a* & *b*, portions of same, magnified.

Fig. 2. *Plumularia struthionides*, nat. size: *a*, portion of stem, magnified; *b*, vesicle, magnified; *c*, portion of pinna, magnified; *d* & *e*, cells, more highly magnified.

XXIX.—*On Additions to the Madeiran Coleoptera.* By T. Vernon Wollaston, M.A., F.L.S.

[Continued from p. 222.]

Fam. Colydiadæ.

Genus Tarphius.

(Germar) Erichs., Nat. der Ins. Deutschl. iii. 256 (1848).

Tarphius angusticollis, n. sp.

T. subrotundato-ovatus, subnitidus, niger; prothorace angusto, antice et postice attenuato, angulis anticis valde acutis porrectis, granulis crebris magnis obtusissimis obsito; elytris rotundatis convexis concoloribus profunde seriatim punctatis, interstitiis alternis leviter elevatis interruptis, nodos distinctos (plus minus aureo-setosos) efformantibus; femoribus tibiisque nigrescenti-piceis, tarsis antennisque picescenti-ferrugineis, harum capitulo sensim majusculo.

Long. corp. lin. $1\frac{1}{2}$–$1\frac{2}{3}$.

Habitat locos editiores sylvaticos Maderæ, in regione Fanalensi a Dom. Bewicke æstate A.D. 1859 detectus.

T. roundish-ovate, deep-black, almost free from scales, and a little shining. *Head* and *prothorax* beset with very close, large, and exceedingly obtuse granules: the *latter* nearly unchanneled, altogether narrow, but attennuated before and behind (the sides being suddenly expanded about the middle), and with the anterior angles even more acute and prominent than is the case in

the *Tarphii* generally. *Elytra* concolorous, rounded and convex, deeply seriate-punctate, and without transverse wrinkles,—the punctures being large, regular, and distinct; the alternate interstices a little raised and much interrupted, forming small but very conspicuous nodules in the usual positions, which are more or less clothed with yellowish, or golden, setæ. *Femora* and *tibiæ* blackish-piceous; the *tarsi* and *antennæ* (the latter of which have their club, especially the apical joint, a little larger and more abrupt than in the generality of the *Tarphii*) piceo-ferruginous.

Eight specimens of the present very distinct *Tarphius* were captured by Mr. Bewicke in Madeira proper,—in the upland region of the Fanal (more than 4000 feet above the sea), during the summer of 1859. Although with many characters which belong to neither of them, it is in some respects intermediate between the *T. sylvicola* and *Lauri*, combining the dark hue, rounded elytra, and deep sculpture of the former, with the posteriorly constricted (but altogether narrower, and otherwise different) prothorax of the latter. Nevertheless, in its very distinct nodules (which are more or less sparingly clothed with golden setæ), and its rather larger antennal club, it recedes, *inter alia*, from them both. I have adopted the above trivial name in allusion to the general narrowness of its prothorax.

Genus Aglenus.

Erichson, Nat. der Ins. Deutsch. iii. 285 (1848).

The genera *Aglenus* and *Anommatus* are both of them additions to the Madeiran fauna; and in their small, glabrous, shining bodies, and obsolete eyes, as well as in their general aspect and habits, they have much in common. Still I believe, in reality, with M. Jacquelin Duval (*vide* Gen. des Col. d'Europe, ii. 242), that, in spite of their resemblance to a certain extent, they belong to distinct families; and hence I would record the former of them only as a member of the *Colydiadæ*. Apart from their specific differences, which are very conspicuous, *Aglenus* may be known from *Anommatus* by, *inter alia*, its distinctly 11-jointed antennæ, with their loosely-connected triarticulate club, by its slenderer limbs, and its evidently tetramerous feet. They are both of them found beneath vegetable substances,—*Aglenus*, however, preferring comparatively dry refuse, like that which accumulates round the edges of hay- and corn-stacks (to which it is much attached), and sometimes occurring even beneath bones; whilst *Anommatus* is more commonly found under logs of moist rotting timber on the damp ground.

Aglenus brunneus, Gyll.

A. fusiformi-cylindricus, rufo-castaneus, nitidus, glaber; capite prothoraceque distincte, elytris leviter et minus crebre punctatis.

Long. corp. lin. $\frac{3}{4}$–$\frac{7}{8}$.

Habitat in locis inferioribus Maderæ, a Dom. E. Leacock prope urbem Funchalensem repertus.

Hypophlœus? brunneus, Gyll., Ins. Suec. iii. 711 (1813).
Cerylon obsoletum, Steph., Ill., Brit. Ent. iii. 98 (1830).
Anommatus obsoletum, Shuck., Brit. Col. Del. 27, pl. 33. f. 2 (1840).
Aglenus brunneus, Erichs., Nat. der Ins. Deutschl. iii. 285 (1848).

A. fusiform-cylindric, being a little constricted at the junction of the prothorax and elytra, reddish-chestnut, bright, and glabrous. *Head* and *prothorax* closely and distinctly punctured, the punctures having a tendency to become confluent. *Elytra* much emarginated at their base, causing the shoulders to appear advanced; less deeply, and not quite so closely, punctured as the head and prothorax,—the punctures with scarcely any tendency to be disposed in rows. *Limbs* a shade paler than the rest of the surface.

The European *A. brunneus* was first detected in Madeira by Mr. Edmund Leacock (and subsequently by myself in the same locality), beneath some bones and logs of wood in a small outhouse, in his garden at the Quinta de São João, near Funchal; and it was shortly afterwards captured by Mr. Bewicke amongst vegetable refuse at the Palmeira.

Genus Prostheca, nov. gen.

Corpus parvum, angustum, lineare, asperatum: *capite* porrecto: *prothorace* longiusculo trapeziformi, ad latera subserrato, antice leviter emarginato: *scutello* minuto (ægre observando): *alis* (nisi fallor) obsoletis: *abdomine* e segmentis sex (?) composito (apicali minutissimo vix perspicuo). *Antennæ* prothoracis fere longitudine, rectæ, articulis 1^mo^ et 2^do^ sat magnis crassiusculis (hoc illo vix minore), 3^tio^ usque ad nonum multo brevioribus minoribus paulo angustioribus inter se æqualibus, 10^mo^ et 11^mo^ capitulum magnum solidum rotundatum valde abruptum biarticulatum efficientibus, inter se arcte applicatis (sutura vix observanda). *Labrum* membranaceum antice vix solidius, quadratum (margine antico integro, angulis vix rotundatis ciliatis). *Mandibulæ* validæ corneæ triangulares, intus haud dentatæ, sed circa medium leviter incisæ et membrana parva instructæ. *Maxillæ* bilobæ: *lobo externo* breviusculo subrecto, apice subito truncato et dense barbato; *interno* paulo breviore minore, apicem versus dense barbato sed vix uncinato. *Palpi maxillares* articulis 1^mo^, 2^do^, et 3^tio^ longitudine subæqualibus, 1^mo^ leviter flexuoso, 2^do^ et 3^tio^ crassioribus (illo subclavato, hoc subgloboso), ultimo magno elongato incrassato ovali apice vix acuminato; *labiales* e scapis ligulæ connatis surgentes, articulis 1^mo^ et 2^do^

subæqualibus (illo subflexuoso, hoc paulo crassiore subclavato), ultimo magno (ut in palpis maxillaribus). *Mentum* magnum transverso-quadratum, antice vix angustatum. *Ligula* magna sat robusta subquadrata, apice integra ciliata. *Pedes* validi subcontractiles, basi vix distantes: *femoribus* apicem versus subclavatis: *tibiis* bicalcaratis, extus (præsertim *anticis*) irregulariter erosis, aut potius subserratis: *tarsis* 4-articulatis, articulis tribus baseos inter se subæqualibus, 4to valde elongato flexuoso subclavato, *unguiculis* simplicibus munito.

A πρὸς et τίθημι, [sc. faunæ] accessio.

The small insect from which the above characters have been drawn is hitherto unique; nevertheless, I have fortunately succeeded, in my dissection of it, in securing all the parts of its mouth, so that I can have no hesitation as to its affinities. Its entire structure and quadriarticulate feet leave no doubt whatsoever, on my mind, that it is rightly referred to the *Colydiadæ*; and I believe that its nearest allies are the European genera *Pycnomerus* and *Xylolæmus*. Indeed with the former of these it has so much in common that I at first thought it might be almost associated with it; nevertheless, its more abruptly clavated antennæ and different mandibles (which are entire at the apex, and without the deep incision towards their base behind), in conjunction with its much *squarer* (or more angulated) labrum, mentum, and ligula, will, apart from minor points, prevent its fusion into *Pycnomerus*; whilst from *Xylolæmus* (which it much resembles in its trapeziform, margined, and laterally crenulated prothorax), its undentated mandibles, and the somewhat differently proportioned joints of its antennæ and palpi will (as I judge from the description), *inter alia*, readily separate it.

Prostheca aspera, n. sp.

P. linearis, fusco-ferruginea subopaca; capite prothoraceque rugosis, tuberculatis et setulis paucis valde distantibus obsitis; hoc fere æquali, postice angustiore, ad latera oblique recto, angulis anticis porrectis paulo explanatis subrecurvis; elytris obsoletissime subseriatim punctatis, interstitiis subcrenato-costatis et setulis longitudinaliter obsitis; antennis pedibusque vix pallidioribus.

Long. corp. lin. 1.

Habitat Maderam, a Dom. Bewicke nuper communicata.

P. narrow, linear, elongate, dull brownish-ferruginous, and nearly opake. *Head* and *prothorax* much roughened, and beset with large but not very elevated tubercles, sprinkled with short remote setæ: the *former* subquadrate; the *latter* elongated, slightly narrowed behind, with the sides nearly straight (but oblique) and margined, and with the anterior angles thickened, porrected, and slightly recurved. *Elytra* with very shallow, and almost obsolete, punctures arranged in longitudinal rows, and

with the interstices apparently [for the sculpture is somewhat obscure] subcostate and crenulated; and with longitudinal rows of short distant setæ down each. *Limbs* a little paler than the rest of the surface.

The discovery of this curious beetle is due to the indefatigable researches of Mr. Bewicke, who captured a single specimen of it in his garden at the Palmeira, above Funchal, amongst some dried stems of the *Euphorbia piscatoria* which he had brought several months before from Porto Novo, on the eastern coast. Whether, therefore, it was transported to Funchal, along with the numerous other Coleoptera which inhabit the stems of the Euphorbias, or whether its appearance amongst them was merely accidental, it is impossible at present to decide. Be this, however, as it may, there is, at any rate, no reason for suspecting that the insect is otherwise than indigenous.

Genus Lyctus.

Fabricius, Ent. Syst. i. ii. 502 (1792).

Lyctus Leacocianus, n. sp.

L. cylindricus, parce pubescens, niger; capite prothoraceque crebre et profunde punctatis, hoc subquadrato, angulis anticis haud productis sed posticis paulo acuminatis; elytris leviter sub-biseriatim punctatis (punctis elongatis angustis), sutura interstitiisque alternis obsoletissime elevatis; antennis (robustis) pedibusque piceis.
Long. corp. lin. $2\frac{1}{8}$.

Habitat Maderam australem, prope urbem Funchalensem a Dom. E. Leacock repertus, cujus in honorem nomen triviale proposui.

L. linear and cylindrical, but rather broader than the *L. brunneus*, also of a darker hue (being nearly black), and somewhat less densely clothed with decumbent fulvous pubescence. *Head* and *prothorax* a little more coarsely punctured: the *latter* more strictly quadrate—the anterior angles being rounded-off, and not downwardly produced as in that species; but with the extreme hinder angles more acute, or prominent; the sides not perceptibly crenulated, even beneath the microscope; the disk rather more even and convex, but nevertheless with the longitudinal depression more lengthened, or converted into a wide dorsal channel. *Elytra* more closely and distinctly punctulated than in the *L. brunneus*, the punctures being narrow and elongated (like broken striæ), with a tendency to be arranged in double longitudinal rows, and both smaller and more dense (as well as more irregular) towards the suture than towards the margin; the suture and alternate interstices obsoletely raised. *Limbs* dark-piceous; the *antennæ* more robust than those of the *L. brunneus*.

The present important addition to the fauna is due to the researches of Mr. Edmund Leacock, who detected the single specimen from which the above comparative description has been compiled in his garden at the Quinta de São João, near Funchal. Its dark hue and totally different prothorax, in conjunction with its comparatively robust antennæ and curious elytral sculpture, will, apart from minor differences, at once separate it from its ally the *L. brunneus*. I have named it after its discoverer, whose successful labours have so often augmented the Madeiran Catalogue.

Fam. **Lathridiadæ.**

Genus Anommatus.

Wesmaël, Bull. de l'Acad. de Bruxell. ii. 339, tab. 4 (1836).

The little *Anommatus* 12-*striatus* bears, as already stated, so strong a *primâ facie* resemblance to *Aglenus* that it has been universally, with one exception, placed alongside that genus, amongst the *Colydiadæ*. Nevertheless, the various authors who have thus tacitly acknowledged its affinities seem merely to have followed blindly in the wake of Erichson, whose description of its structural details was, as M. Jacquelin Duval has recently well remarked, both loose and incorrect; and, after a very careful dissection of it, I agree with M. Duval that it should be undoubtedly assigned to the *Lathridiadæ*. True it is that its robust limbs and abruptly clavated antennæ are not in accordance with the normal members of that family; but then, on the other hand, neither are they universally indicative of the *Colydini*; whilst even amongst the *Lathridiadæ* such genera as *Cholovocera* and *Merophysia* afford us an abundant precedent for the supposition that the terminal joints of the antennæ may sometimes, in that group, become absolutely lost by uniting into a densely compact mass. Then, with respect to the tarsi of *Anommatus*, having mounted them in Canada balsam for microscopic observation, I believe that M. Jacquelin Duval is perfectly right in regarding them as triarticulate, instead of quadriarticulate, as stated by Erichson. The basal joint is certainly a little constricted on its under side, but even polarized light will not show the merest rudiment of a suture; and I have not the slightest hesitation, therefore, in concluding it to be a single joint, and the whole foot to be, consequently, triarticulate—which is almost universally the case with the *Lathridiadæ*. The antennæ are composed of only nine joints besides the club,—which latter is extremely compact, and with no annular traces on it whatso-

ever, so far as I can detect: hence, although we *assume* that the two ultimate joints are fused into it, we must practically regard the entire number [*i.e.* the recognizable number] as diminished, from the normal standard,—which is, likewise, perfectly in accordance with the generality of the *Lathridiadæ*, in which the recognizable antennal joints vary from 8 to 11. Of these joints, the 1st and the 2nd are in *Anommatus* large and robust; the 3rd very much more slender and of almost the same length as the 2nd; the 4th, 5th, 6th, 7th, 8th, and 9th extremely short, but gradually becoming broader; and then follows the immense subglobose club, which must be regarded as swallowing up the remaining two articulations. I believe, all points considered, that *Anommatus* is more nearly akin to the (likewise blind) *Langelandia anophthalma* than to almost any other, perhaps, of our European genera; and, in the Madeiran Catalogue, I would place it at the commencement of the *Lathridiadæ*, near to *Cholovocera*.

Anommatus 12-*striatus*, Müll.

A. parallelo-oblongus, testaceus, nitidus, glaber; prothorace valde profunde sed remote punctato (punctis maximis, in dorso subseriatim); elytris profunde punctato-striatis.

Long. corp. lin. $\frac{2}{3}$.

Habitat Maderam, sub truncis arborum prolapsis, rarissimus.

Lyctus 12-*striatus*, Müll., in Germ. Mag. iv. 190 (1821).
Anommatus terricola, Wesm., Bull. Acad. Brux. ii. 339. t. 4 (1836).
—— 12-*striatus*, Erichs., Nat. der Ins. Deutschl. iii. 286 (1848).
—— ——, Redt., Fauna Austr. 181 (1849).

A. parallel-oblong, being smaller, more linear, and less convex than the *Aglenus brunneus*, pale-testaceous, very bright, and glabrous. *Head* sparingly, but not very deeply punctured. *Prothorax*, rather widened anteriorly, very deeply and remotely punctured,—the punctures being very large, and on either side of the central line (which is just perceptibly keeled) with a tendency to be disposed in rows. *Elytra* deeply striate-punctate (the punctures being there also very large). *Limbs* a shade paler than the rest of the surface.

Detected by myself, in tolerable abundance, beneath the trunk of a felled cherry-tree which was lying on the damp ground at the bottom of the Curral das Freiras, whilst encamped there, with the Rev. R. T. Lowe, on the 9th of Dec. 1858. And a specimen has been lately communicated by Sr. Moniz, which he captured under the chippings of Spanish chestnut-trees at Santa Anna, in the north of Madeira.

Genus Holoparamecus.

Curtis, Ent. Mag. i. 186 (1833).

Holoparamecus Kunzei, Aubé.

H. elongato-oblongus, angustus, rufo-testaceus, subnitidus et subtiliter pubescens; prothorace ad latera minus curvato, postice paulo angustato et in medio inæqualiter transverso-signato; elytro singulo stria suturali recta impresso; antennis 10-articulatis.

Long. corp. lin. $\frac{2}{3}$.

Habitat Maderam australem, a Dom. Bewicke prope urbem Funchalensem captus.

Calyptobium Kunzei, Aubé, Ann. de la Soc. Ent. de France (2ième série), i. (1843).

H. larger and more linear than the *H. niger*, the elytra being much longer in proportion; also of a paler hue, being uniformly rufo-testaceous; much less shining, and scarcely perceptibly punctured, even beneath the microscope, but more evidently pubescent. *Head* narrower than the anterior part of the *prothorax*, which is less curved at the sides, and not so suddenly narrowed behind, as is the case in the *H. niger*, and with its posterior region transversely and unevenly impressed,—the impressed band being narrower in proportion than in that insect, and therefore not continued so close towards the hinder angles (which, in like manner, have their extreme lateral edge a little thickened, but with no tendency to be produced backwards *on the surface* of the pronotum), and being more evidently terminated on each side by a very short longitudinal costa, and interrupted by a still more perceptible one (though equally short) in the centre,—which medial one merges into an obscure dorsal channel in front of the transverse impression, deep on the disk, but evanescent before and behind. *Elytra* more produced, or lengthened, posteriorly than in the *H. niger*, and with the sutural stria on each less curved,—being almost quite parallel with the suture. *Antennæ*, which are composed of ten joints only (instead of eleven, as in the *H. niger*), concolorous with the rest of the surface. *Legs* a shade paler.

The above comparative description will at once point out the distinctions between the present *Holoparamecus* and its Madeiran congener, the *H. niger*. Indeed the structural character of its antennæ, which contain a joint less than those of that insect (the numerical variation of the antennal articulations being one of the peculiarities of the members of this genus), would of itself suffice to separate it; nevertheless, its larger size and many other specific features have been fully recorded in the diagnosis. Although I felt convinced it was the *Calyptobium*

Kunzei of Aubé (that species being the only one hitherto recorded in which the antennæ are 10-articulate), I am nevertheless enabled to state this for certain, Dr. Aubé having kindly transmitted to me from Paris, through M. Allard, one of his three original types of that insect, for comparison; with which the Madeiran specimens agree in every respect. Its discovery in Madeira is due to Mr. Bewicke, who captured several examples of it, about a year ago, in his garden at the Palmeira, above Funchal.

Genus Corticaria.

Marsham, Ent. Brit. i. 106 (1802).

Corticaria pubescens, Gyll.

C. elongato-ovata, fusco-picea, cinereo-pubescens; capite prothoraceque profunde punctatis (punctis maximis), hoc ad latera (præsertim postice) crenulato, fovea postmedia magna profunda rotundata impresso; elytris profunde rugose et dense subseriatim punctatis; antennis pedibusque rufo-ferrugineis, his elongatis.

Long. corp. lin. $1\frac{1}{4}$.

Habitat Maderam australem, a Dom. Bewicke detecta.

Latridius pubescens, Illiger, in litt.
—— ——, Gyll., Ins. Suec. iv. 125 (1827).
Corticaria pubescens, Steph., Ill. Brit. Ent. iii. 106 (1830).
—— —— Redt., Fauna Austr. 208 (1849).

C. elongate-ovate, brownish-piceous, with a more or less subrufescent tinge, and clothed with long decumbent cinereous pile. *Head* and *prothorax* very deeply punctured, the punctures being extremely large, but (especially on the former) not very dense: the *latter* with the edges a good deal rounded, and crenulated (particularly posteriorly); and with a very large, rounded and deeply impressed fovea on the centre of the hinder disk. *Elytra* deeply, thickly, and rugosely subseriate-punctate (the punctures having only a tendency to being disposed in longitudinal rows). *Limbs* rufo-ferruginous; the *legs* longer than in the generality of the *Corticariæ*.

A single example of the common European *C. pubescens* was detected by Mr. Bewicke, about a year ago, near Funchal. It may be readily known from the rest of the Madeiran *Corticariæ* by its comparatively large size, brownish-ferruginous hue, and densely pubescent surface, by the immense and very deep punctures of its head and prothorax, by the somewhat close sculpture of its elytra, and the length of its legs. It has probably been imported into the island from more northern latitudes.

Corticaria inconspicua, n. sp.

C. elongata, rufo-ferruginea, subdepressa; capite prothoraceque pro-

funde et sat crebre punctatis, hoc ad latera (præsertim postice) crenulato, fovea postmedia profunda rotundata impresso; elytris leviter sed rugulose striato-punctatis; antennis pedibusque paulo pallidioribus.

Long. corp. lin. $\frac{1}{2}$–$\frac{2}{3}$.

Habitat Maderam, in horto Leacociano prope Funchal a meipso detecta; necnon ad S. Antonio da Serra deprehensit Dom. Bewicke.

C. similar to the *C. rotulicollis* [*Ins. Mad.* 184], but smaller, just perceptily less convex, and of a more uniformly rufo-ferruginous hue, the elytra being usually not at all darker than the head and prothorax. *Prothorax* a little less closely punctured than in that insect, with its hinder foveæ perhaps somewhat larger, and with its lateral crenulations not quite so powerful, and less numerous; or, at any rate, with the anterior ones smaller and less evident. *Elytra* not quite so deeply striate-punctate, and the apex of the *antennæ* a trifle paler, or less obscured.

An insignificant little *Corticaria,* appearing at first sight like a depauperated state of the *C. rotulicollis.* It was detected by myself, beneath bones and chippings of wood, in a small outhouse in Mr. Leacock's garden at the Quinta de São João, near Funchal; in which locality it was subsequently taken both by Mr. E. Leacock and Mr. Bewicke, the latter of whom likewise captured it, during August 1859, in a hovel at S. Antonio da Serra.

Genus Metophthalmus.

Wollaston, Ins. Mad. 192 (1854).

Metophthalmus exiguus, n. sp.

M. forma et sculptura *M. asperato* simillimus, sed minutissimus, omnino rufo-ferrugineus, fronte minus costato, ocello distinctiore et antennarum articulis inter se diversis [sc. tertio ad octavum minutis subglobosis subæqualibus moniliformibus, nono subgloboso (haud poculiformi), et ultimo oblongo (nec oblique truncato)].

Long. corp. lin. $\frac{1}{2}$.

Habitat Maderam australem: specimen unicum prope urbem Funchalensem æstate 1859 cepit Dom. Bewicke.

M. very like in form and sculpture to the *M. asperatus,* except that it is much smaller and of a uniformly ferruginous, or rufo-ferruginous, hue, with its frontal costæ much less evident, or almost obsolete, but with the ocellus better defined; with its prothorax also somewhat less uneven; and with its antennal joints [*vide* the above diagnosis] differently proportioned.

A single specimen of it has been lately detected in Madeira

Proper by Mr. Bewicke, to whose indefatigable researches we are indebted for so many additions to our fauna. He informs me that he found it amongst some "Euphorbia rubbish" in his garden at the Palmeira, in company with the (likewise unique) *Prostheca aspera*, but was not able to obtain another specimen. Its 10-articulated antennæ, and the minutely serrated margins of its head, prothorax, and elytra, in conjunction with the very peculiar construction (and position) of its eyes, at once show it to be a true *Metophthalmus*; nevertheless, in the relative proportions and shape of its antennal joints, it recedes from the *M. asperatus* very considerably. Thus, all the joints from the third to the eighth inclusive are minute, subglobose, and moniliform, being nearly equal throughout; whereas in the *M. asperatus* the fourth is very much longer than the (diminutive) third one; and from thence to the eighth they sensibly decrease in length, and increase a little (though only a very little) in breadth. Then the (biarticulated) club itself is somewhat different, the penultimate joint being almost globose, and the terminal one oblong; whereas in the *M. asperatus* the ninth joint is distinctly poculiform, and the tenth largely truncated, in an oblique direction, internally, causing it to be much acuminated at its inner apex.

Judging both from the description and the figure, I have little doubt that the genus *Bonvouloiria* of Jacquelin Duval [*vide* Genera des Coléop. d'Europe, ii. 245, A.D. 1857–59] is in reality coincident with *Metophthalmus*; for, although M. Duval describes the antennæ as only 9-articulate, still the third joint is so very minute that it might be mistaken for a portion of the second, by which indeed it is also, when in its normal position, somewhat hidden; so that it might be easily overlooked, unless the antenna be flattened out and mounted in Canada Balsam for the microscope. He does not describe any of the oral organs of his insect, except the upper lip and the terminal joint of the maxillary palpi; but these so entirely correspond with those of the *M. asperatus*, whilst the external details to which he calls attention are so exactly in accordance with those observed by myself in Madeira, that I am the more inclined to suspect that he was mistaken as to the precise number of its antennal joints. Moreover, the *habit* of the *Bonvouloiria niveicollis* is precisely that of the *Metophthalmus*; for he expressly notices the curious *chalky substance* ("la substance blanche crétacée") with which the under sides, as well as a portion of the head and prothorax, of his specimens (which he captured near Montpelier) were covered,—a peculiarity which I pointed out in my Madeiran Catalogue in 1857, where I stated that I believed this white powdery matter to be the particles of

a minute Mould or *Thallus* (the *Rhinotrichum Bloxhami* of Berkeley), on which I detected the *M. asperatus* apparently feeding, amongst the rotten tinder-like wood of an old Til-tree. Whether either of the Madeiran species is identical with M. Jacquelin Duval's, I will not undertake to say; but, from one or two points in his diagnosis, I am inclined to believe that they are both distinct from it.

Genus Monotoma.

Herbst, Natursyst. v. (1793).

Monotoma quadricollis, Aubé.

M. sublinearis, picea, opaca, pilis pallidioribus brevibus vestita; oculis paulo ante basin capitis sitis; capite prothoraceque subrugulosis sed minus distincte punctatis, hoc elongato-quadrato angulis anticis paulo incrassatis sed vix spiniformibus; elytris leviter striato-punctatis et seriatim pilosis, ferrugineis, regione scutellari obscuriore; antennis pedibusque rufo-ferrugineis.

Long. corp. lin. $1-1\frac{1}{8}$.

Habitat Maderam, in horto Bewickiano prope Funchal sub foliis marcidis abundans.

Monotoma quadricollis, Aubé, Ann. de la Soc. Ent. de France, vi. 465. pl. 17. f. 7 (1837).

—— —— Redt., Fauna Austr. 203 (1849).

M. rather narrow and linear, piceous, opake, and clothed (though not very densely) with a short, rigid, decumbent, paler pile. *Head* and *prothorax* punctured and slightly roughened, the punctures, however, not being so deep or well-defined as in either the *M. spinifera* or *congener*: the *former* rather longer, or less truncated posteriorly, than in the *M. congener*, and with the *eyes* a little further removed from the hinder rim (which is not quite so narrow and prominent as in that insect): the *latter* elongato-quadrate, being of nearly equal breadth throughout, and with the sides almost straight; with the lateral edges minutely crenulated; with the angles not produced,—though the anterior ones are somewhat thickened, or enlarged, and the posterior ones minutely prominent; and with indications of a small obsolete fovea on either side of the disk behind. *Elytra* ferruginous, but more or less obscured about the region of the scutellum, faintly striate-punctate, and (as in the following species) with the pubescence arranged in very distinct longitudinal rows. *Limbs* bright rufo-ferruginous.

Detected abundantly by Mr. Bewicke and myself, in company with the *M. spinifera*, beneath dead leaves and vegetable refuse, in his garden at the Palmeira, above Funchal, during December of 1858; as also, subsequently, at the Praia Formosa. Its

distinctions from the *M. congener*, to which it appears at first sight much allied, may be readily gathered from the description; nevertheless, apart from minor characters, its somewhat narrower and more linear outline, in conjunction with its paler elytra, more pubescent and less deeply sculptured surface, and its elongate-quadrate prothorax, will at once separate it from that insect. It seems to differ in no respect, so far as I can perceive, from the European *M. quadricollis.*

Monotoma quadrifoveolata, Aubé.

M. rufo-ferruginea, subopaca, pilis pallidioribus brevibus sat dense vestita; capite postice subquadrato; oculis parvulis, longe ante basin capitis sitis; prothorace quadrato, ad latera valde incrassato-marginato recto, sulcis duobus maximis interruptis (foveas quatuor efficientibus) longitudinaliter impresso; elytris leviter striato-punctatis et seriatim pilosis.

Long. corp. lin. $\frac{7}{8}$–1.

Habitat Maderam australem, sub ossibus desiccatis et ligno in horto Leacociano prope Funchal sat vulgaris.

Monotoma 4-foveolata, Aubé, Ann. de la Soc. Ent. de France, vi. 468, pl. 17. f. 9 (1837).
—— ——, Redt., Fauna Austr. 203 (1849).

M. pale reddish-ferruginous, nearly opake, and densely clothed with a short, rigid, decumbent, paler pile. *Head* and *prothorax* apparently not much punctured (if indeed at all—the surface being hidden by the pubescence): the *former* rather large, and square behind, with the *eyes* small, black, and situated at a considerable distance from the extreme base: the *latter* subquadrate, being quite straight at the sides, and of almost equal breadth before and behind; with the lateral edges strongly margined or thickened, but only appearing minutely crenulated beneath a high magnifying power; with the angles not at all produced; and with a very broad and deep longitudinal channel on either side of the disk, each of which is a little interrupted transversely in the centre,—so as to constitute, in all, four foveæ. *Elytra* faintly striate-punctate, and with the pubescence arranged in longitudinal rows down each of the series of punctures. *Limbs* (especially the *legs*) a shade paler, or more rufescent, than the rest of the surface.

The *M. 4-foveolata* may be at once known from its three Madeiran allies by (*inter alia*) its pale-ferruginous hue and very pubescent surface, by its comparatively large subquadrate head and small eyes, and by the four deep foveæ and unproduced angles of its almost square and laterally margined prothorax. It was detected by myself, in December 1858, beneath bones and chippings of wood, in a small out-house in Mr. Leacock's

garden at Quinta de São João, near Funchal,—a locality in which it was afterwards abundantly captured both by Mr. E. Leacock and Mr. Bewicke. It agrees precisely with specimens in my possession from France and Austria—unless it be, perhaps, that the Madeiran examples are, on the average, just perceptibly smaller.

Fam. Mycetophagidæ.

Genus Myrmecoxenus.

Chevrolat, in Silb. Rev. Ent. iii. 267 [script. Myrmechixenus] (1835).

The genus *Myrmecoxenus* is usually assigned to the *Lathridiadæ,* to several of the members of which (especially *Corticaria*) it has a great outward resemblance; nevertheless its quadri-articulate feet, and the other details of its structure, seem to me to point to the *Mycetophagidæ* as its more correct location, and to such groups as *Microchondrus* (i. e. *Symbiotes*) and *Mycetæa* as perhaps its nearest allies. Indeed, M. Jacquelin-Duval has already placed it [*vide* Gen. des Coléopt. d'Europe, ii. 223] in juxtaposition with these genera, having, however, formed a separate family (the *Myceteïdes*) for their reception, distinct from the *Mycetophagidæ* proper,—a step which it might perhaps be desirable to adopt, though it is scarcely necessary to do so in a small local fauna. I may just remark that, in spite of its great external resemblance to the *Corticariæ,* it may be known, *inter alia,* by its less abruptly clubbed antennæ (the *four* apical joints of which, instead of only three, are gradually, though distinctly, thickened), and by its quadri- (instead of tri-)articulate feet,—of which, moreover, the hinder ones have their basal joint much elongated.

Myrmecoxenus picinus, Aubé.

M. rufo-piceus, subnitidus, parce cinereo-pubescens, ubique dense et sat fortiter punctatus; prothorace transverso-subquadrato, postice vix attenuato; elytris paulo obscurioribus; antennis pedibusque testaceis.

Long. corp. lin. vix 1.

Habitat Maderam australem, a Dom. Bewicke supra urbem Funchalensem captus.

Myrmechoxenus picinus, Aubé, Ann. de la Soc. Ent. de France (2ième série), viii. 330 (1850).

M. rufo-piceous, slightly shining, sparsely clothed with decumbent cinereous pile, and with the entire upper surface closely, regularly, and rather deeply punctured,—the punctures on the head and prothorax being just perceptibly less dense and deep

than those on the elytra. *Prothorax* transverse-quadrate (being very slightly narrowed behind), and free from all inequalities and depressions. *Elytra* a little shorter than the abdomen (which is black, and has the pygidium partially exposed), and a shade darker in colour than the head and prothorax; the punctures without the slightest tendency to be disposed in longitudinal rows. *Limbs* testaceous.

I have but little hesitation in referring the present insect to the *M. picinus* of Aubé (from Corsica and Algeria), with the description of which it agrees exactly. It is of about the size, and nearly the outline, of the European *M. vaporariorum*; nevertheless, it is darker than that species (being rufo-piceous instead of testaceous, and with its elytra almost piceous), more shining, rather less pubescent, and with its punctation very much larger and deeper. A single specimen of it has been captured by Mr. Bewicke, in his garden at the Palmeira, above Funchal.

Fam. Dermestidæ.

Genus Attagenus.

Latreille, Gen. Crust. et Ins. ii. 32 (1802).

Attagenus Schæfferi, Herbst.

A. ovalis, nigro-piceus, supra nigro- et (saltem intra angulos prothoracis posticos) subflavescenti-pubescens, infra subcinereo-flavescenti-pubescens; elytris plus minus distincte picescentioribus; antennarum basi pedibusque ferrugineis.

Long. corp. lin. $1\frac{3}{4}$–2.

Mas, antennarum articulo ultimo longissimo, subarcuato, ensiformi.

Habitat urbem Funchalensem, in domibus mercatorumque repositoriis a Dom. Moniz æstate 1858 detectus.

Megatoma Schæfferi, Hbst., Käf. iv. 93.
Dermestes Schæfferi, Gyll., Ins. Suec. i. 152 (1808).
Attagenus Schäfferi, Erichs., Nat. der Ins. Deutschl. iii. 440 (1848).

A. similar to the *A. megatoma*, but a little larger and more piceous (especially the elytra, which are sometimes subrufescent), and with a slight admixture of yellowish-cinereous (along with the black) pile on the anterior part of its upper surface,—particularly along the hinder margin of the prothorax, and occasionally also towards the extreme base of the elytra. The *males* with the ultimate joint of their antennæ even longer still than in the *A. megatoma*, and slightly bent, or ensiform.

Several specimens of this insect, which approaches very closely, at first sight, to the *A. megatoma*, but which (even though not according *precisely* with Erichson's description) I believe to be correctly referred to the European *A. Schæfferi* (and which, I

should add, has been compared by my friend Dr. Schaum with examples of that species in the Museum at Berlin), were captured by Senhôr Moniz, in the houses and shops of Funchal, during the summer of 1858; and I may state that I have myself taken it in similar positions in the Canary Islands.

[To be continued.]

XXX.—*On the Tribe* Colletieæ, *with some Observations on the Structure of the Seed in the Family of the* Rhamnaceæ. By John Miers, F.R.S., F.L.S. &c.

[Continued from p. 216.]

2. Notophæna.

I propose this genus for a separate group, with flowers distinguished by the same peculiarity as those of *Colletia*—the total absence of petals,—but differing from the latter genus in its habit, its copious foliage, and in the form of its disk, which resembles that of *Discaria*. It is also characterized by the peculiar feature before alluded to—the union of the base of the opposite stipules, which gives an appearance of an articulation at every node,—a peculiarity often seen also in the middle of the spines when they are foliiferous. The type of the genus is the *Colletia serratifolia* of Ventenat, from Chile; the other species are mostly from the southern parts of the same country, and one is from New Zealand: hence the generic name, from *νότος*, *auster*; *φαίνομαι*, *appareo*. They sometimes form very leafy shrubs, at other times low decumbent bushes, bare of spines. Here we generally see a spineless branchlet issuing from below each spine, and bearing both leaves and flowers, which quite confirms the supposition that the scaly tubercle seen in *Colletia* and other genera is only a very abbreviated or suppressed branchlet.

Notophæna, gen. nov.;—*Calyx* urceolato-campanulatus, usque ad medium 4–5-fidus, laciniis reflexis, intus carina prominula calloque apicali notatis, æstivatione valvatis, imo demum circumscissus. *Petala* nulla. *Stamina* 4–5, tubo calycino inter lacinias inserta; *filamenta* filiformia, laciniis breviora, erecta; *antheræ* ovatæ, 2-lobæ, 2-loculares, loculis rima longitudinali antice hiantibus. *Discus* pateriformis, hypogynus, imo tubi adnatus, margine brevi, libero, crenato. *Ovarium* superum, globosum, sæpe pilosum, 3-sulcatum, 3-loculare; *ovula* in loculis solitaria, erecta. *Stylus* brevis, calycis tubum æquans. *Stigma* obtusum, breviter 3-lobum. *Fructus* siccus, subglobosus, cupula calycina discoque suffultus et adnatus, in coccos 3 resiliens; istis seminibusque ut in *Colletia*.

Suffrutices (vel arbusculæ) *Chilenses, Magellanici et Novæ Zelandici,* ramulis *decussatis, elongatis, spinosis vel sæpius inermibus*; foliis *oppositis, ellipticis, crenulato-dentatis, discoloribus*; floribus *parvis, infra spinas, axillaribus, pedunculatis, solitariis, vel fasciculatis.*

1. *Notophæna serratifolia,* nob. Colletia serratifolia, *Vent.* (*non Hook.*) *Hort. Cels.* 92. tab. 15; *DC. Prodr.* ii. 28; *Brongn. Ann. Sc. Nat.* x. 366; *Lam. Dict. Suppl.* ii. 312; *id. Illustr.* pl. 930. Rhamnus Spartium, *Dombey*;—ramosa, ramis ramulisque patentissimis, virgatis, sub-4-gonis, sublævibus, glaberrimis, parce foliosis, subspinosis, spinis longiusculis, foliosis, apice calloso-pungentibus, patentibus; foliis internodiis æquilongis, sæpe 3, fasciculatis, oblongis, vel lineari-oblongis, apice bisinuatis et mucronatis, imo in petiolum brevem attenuatis, breviter serrato-denticulatis, dentibus glanduliferis, crassiusculis, enerviis, utrinque glaberrimis, subtus pallide flavis, stipulis navicularibus, linea transversali prominente inter se nexis, nodis hinc quasi articulatis; floribus axillaribus, subsolitariis, pedunculo calyce longiore, filiformi; calycis tubo brevi, imo inflato, limbi laciniis 5, brevibus, reflexis, staminibus ori insitis, stylo exserto.—Chile.—*v. s. in herb. Mus. Paris,* "Pérou" (sine dubio erroneo), Dombey.

This species differs from the following, with which it has been generally confounded, in its green, slender, almost herbaceous stems and branchlets, which are somewhat angular, spreading nearly at a right angle, quite glabrous, furnished with spines, and sometimes bare of leaves, in its fewer or more deciduous, smaller, and nerveless leaves, in its fewer and larger flowers, and its larger fruit. The internodes are from $\frac{1}{2}$ inch to 1 inch apart, and are almost articulated at each axil by the stipular extension before described; the divaricated spines, decussating at each axil, are about the length of the internodes, and are foliiferous in their middle: in the younger floriferous branchlets, the spines are wanting at the nodes, from which one to three leaves spring on each side; the leaves are 4 to 7 lines long, $1\frac{1}{2}$ to 2 lines broad, bearing small glandular teeth on the margin, of which three, more conspicuous than the others, terminate the apex.

The specimen from which this account is derived is the original type described by Ventenat: the flowers here have all fallen away, but the fruit remains, generally solitary in the axils; he peduncle is 5 or 6 lines long, and the 3-lobed capsule is about 3 lines in diameter *.

* A drawing of this species will be shown in the 'Contributions,' Plate 37 A.

2. *Notophæna foliosa*, nob. Colletia serratifolia, *Hook.* (*non Vent.*) *var. β, foliosa, Bot. Misc.* iii. 173. C. crenata, *Clos, loc. cit.* 35. Rhamnus diffusus, *Clos, in Gay, Chile,* ii. 20;—arbuscula frondosa, ramis ramulisque haud patentibus, nonnullis spinescentibus, spinisque erectioribus, virgatis, teretibus, striatis, pallidis, aut sæpius fusco-rubris; ramulis novellis inermibus, erectiusculis, elongatis vel abbreviatis, foliiferis et floriferis, et infra spinas (ubi adsunt) nascentibus; stipulis oppositis, rubellis, latiusculis, breviter trigonis, concavis, apice 2-dentatis, imo linea transversali circa caulem connexis; foliis oppositis, ellipticis, vel oblongis, apice obtusis et mucronulatis, imo acutioribus, crenulato-dentatis, dentibus sæpius fere obsoletis, supra læte viridibus, subtus pallide glaucis, penninerviis, nervis fuscis anastomosantibus, glabris, vel sub lente parce puberulis, petiolo canaliculato, tenui; floribus 3, fasciculatis ex quaque axilla; pedunculo erecto, demum incurvo; calyceque glabro, urceolato, 5-fido; staminibus erectis, laciniis reflexis, æquilongis; ovario piloso, stylo glabro, longe exserto; fructu minore.—Chile.—*v. s. in variis herbariis*; Valparaiso (Cuming, 427–637); Valdivia (Bridges, 594); Concepcion (Germain, sub nom. *Trevoa 3-nervis*); *in herb. Mus. Paris* (Gay); Dombey, sub nom. *Rhamnus Chacay.*

This is a small tree, with rather virgate branches and an abundant foliage of small leaves, with long spines, or rather branchlets having an apiculate termination; the branches are quite glabrous; the spines, $\frac{3}{4}$ to $1\frac{1}{4}$ inch long, are always articulated in the middle, and there floriferous; the fertile branchlets that spring from below them bear an abundance of flowers and leaves, with the axils approximated, so that the inflorescence appears somewhat spicated; these branchlets, though sometimes much longer, seldom exceed half an inch in length, bearing in each node two opposite sets of three fasciculated flowers and two opposite leaves; the leaves are from 6 to 9 lines long, 3 lines broad, on a petiole 1 line in length; those of the main branches are 1 inch long, and half an inch broad, the margins generally revolute, with crenated, almost obsolete teeth, and yellowish. The peduncles are nearly 2 lines long; the broad and urceolate tube of the calyx is 1 line long, its segments and erect stamens $\frac{3}{4}$ line in length; the small hypogynous disk, adnate to it, is slightly concave, green, smooth, fleshy, with a raised undulating margin, and is half as broad again as the very pilose ovary which it supports. The 3-coccous fruit is about 2 lines in diameter, and pilose: when the cocci spring out of their bed, which they do with a noise and much elastic force, their persistent cup is seen to be formed of three distinct and

stout membranes,—the base of the calyx, the disk, and the adhering portion of the epicarp. The seeds are oval, dark brown, hard and polished, like those of *Colletia*. The stipules are very conspicuous, especially in the young floriferous branchlets; here they form in each axil a minute hollow navicular cup, with two erect, obtuse, ciliated, red, membranaceous lobes, connected with those of the opposite stipule by a short membranaceous vaginant sheath; the petiole springs out of the sinus between the lobes, and the three peduncles grow out of the hollow of the cup*.

Dombey's plant, labelled as from Peru, is beyond doubt from Chile. Germain's specimens were distributed under the name of *Trevoa 3-nervis*.

3. *Notophæna cognata*, n. sp.;—ramis elongatis, virgatis, angulato-striatis, glaberrimis, spinosis, spinis longiusculis, pungentibus, medio foliiferis; ramulis junioribus floriferis, sub spinis ortis eisque multo longioribus; foliis oppositis, elliptico-oblongis, crenato-serratis, basi latioribus vix acutis, e medio summum versus gradatim angustioribus, ibi obtusis et emarginatis, sub lente utrinque sparsim pilosulis, supra viridibus, subtus pallide glaucis, petiolo canaliculato, puberulo; stipulis vaginaque transversa conspicuis; floribus 2–4, fasciculatis, pedunculis elongatis, petiolo calyceque 2–4-plo longioribus, glabris; calyce glabro, tubo urceolato 4-fido, staminibus 4, laciniis paulo brevioribus, erectis; ovario piloso, stylo elongato, tubo longiore, glabro.—Insula Chiloë.—*v. s. in herb. meo* (Capt. King).

This species is intermediate between the foregoing and the following one, and is distinguished by its more slender branches, larger emarginated leaves, the greater length of its peduncles, and its tetramerous flowers. Its floriferous branchlets measure 3 or 4 inches, its spines about $1\frac{1}{2}$ inch; its leaves are 1 inch long, $\frac{1}{2}$ inch broad, on a petiole 2 lines in length; its peduncles are 3 lines long, the tube of the calyx 1 line long, the same in diameter, and the lobes of its border nearly of equal length†.

4. *Notophæna discolor*. Colletia discolor, *Hook. Icon.* 538; *Hook. fil. Flor. Ant.* ii. 255; *Rich. Voy. Astrol.* p. , pl. 14;—frondosa, glaberrima, ramulis teretibus, strictis, substriatis, fusco-rubris, spinosis, spinis patentibus, longiusculis, valde pungentibus, apicem versus foliiferis; ramulis junioribus florigeris sub spinis enatis, elongatis; foliis oppositis, oblongis obovatisve, obtusis, argute serrulatis, margine subrevoluto, in petiolum brevem attenuatis, supra viridibus, subtus pallide

* This species, with analytical details, will be seen in Plate 37 B of the 'Contributions.'

† A sketch of this plant will be shown in Plate 37 C of the same work.

glaucis, fere enerviis; stipulis transversim nexis, 2-dentatis, dentibus linearibus, acutissimis, ciliatis; floribus parvis, subsolitariis, 4-meris; capsula 3-cocca pilosula. Patagonia.—*v. s. in herb. meo et Hook.*, Port Famine (Capt. King); *in herb. Mus. Paris*, Magellan (Voy. Astrolabe).

This is distinct from the two preceding species, in the smaller size of its obovate leaves, and its smaller flowers, as well as in the shape of its stipules. The discolorous feature of its leaves is common to every species of this genus. The spines are ½ to 1 inch long; the leaves are 5 lines long, 2½ lines broad, on a petiole barely 1 line in length; the peduncle is 2 lines long; the tube of the calyx is ¾ line long, the same in diameter, and its short revolute teeth are only ¼ line in length: the peduncle in fruit becomes thicker; it is then 3 lines long, and is deflected; the 3-coccous fruit is 2 lines in diameter; it is sometimes 4-coccous.

5. *Notophæna Magellanica*, n. sp.;—suffruticosa, inermis, sub lente pilosula, ramulis subangulatis, sub-4-gonis, axillis approximatis; foliis parvulis, ovato-oblongis, utrinque obtusis, vel imo subcuneatis, carnosulis, margine integerrimis, vel obsolete dentatis, supra nitidis, viridibus, subtus pallidis, nervis omnino immersis, petiolo brevissimo, stipulis præcedentis; floribus parvis, in axillis oppositis, utrinque 3, fasciculatis, 4-meris.—In Fretum Magellanicum.—*v. s. in herb. Mus. Paris*, Sandy Point (Lechler, 1029, sub nom. *Colletia discolor*); *in herb. Hook.*, Cordillera de Arauco (Lechler, 2994).

This is a well-marked species; its branchlets have a greyish bark; its axillary nodes are 4 or 5 lines apart, and in the young branchlets 2 lines apart; the leaves are simply opposite, 2½–3 lines long, 1¼ line broad, on a short petiole: the flowers are small, the peduncle being 1 line long; the calyx, including its segments, is of the same length, and ¾ line diameter*.

6. *Notophæna tomentosa.* Colletia tomentosa, *Philippi, Linnæa*, xxviii. 618;—ramis cinereo-tomentosis; foliis parvis, obovatis, læte viridibus, pubescentibus, adpresse serratis: stipulis minutis, ovato-lanceolatis, fuscis; floribus subfasciculatis; pedunculis 1-floris, glabris, calycem glabrum æquantibus, calycibus tubulosis, dentibus reflexis tubum dimidium æquantibus; petalis nullis, staminibus styloque calycem æquantibus.—Chile, prope San Antonio, Prov. Valparaiso.

This diagnosis is copied from Dr. Philippi's description in the

* This species will be represented in Plate 37 D of the 'Contributions.'

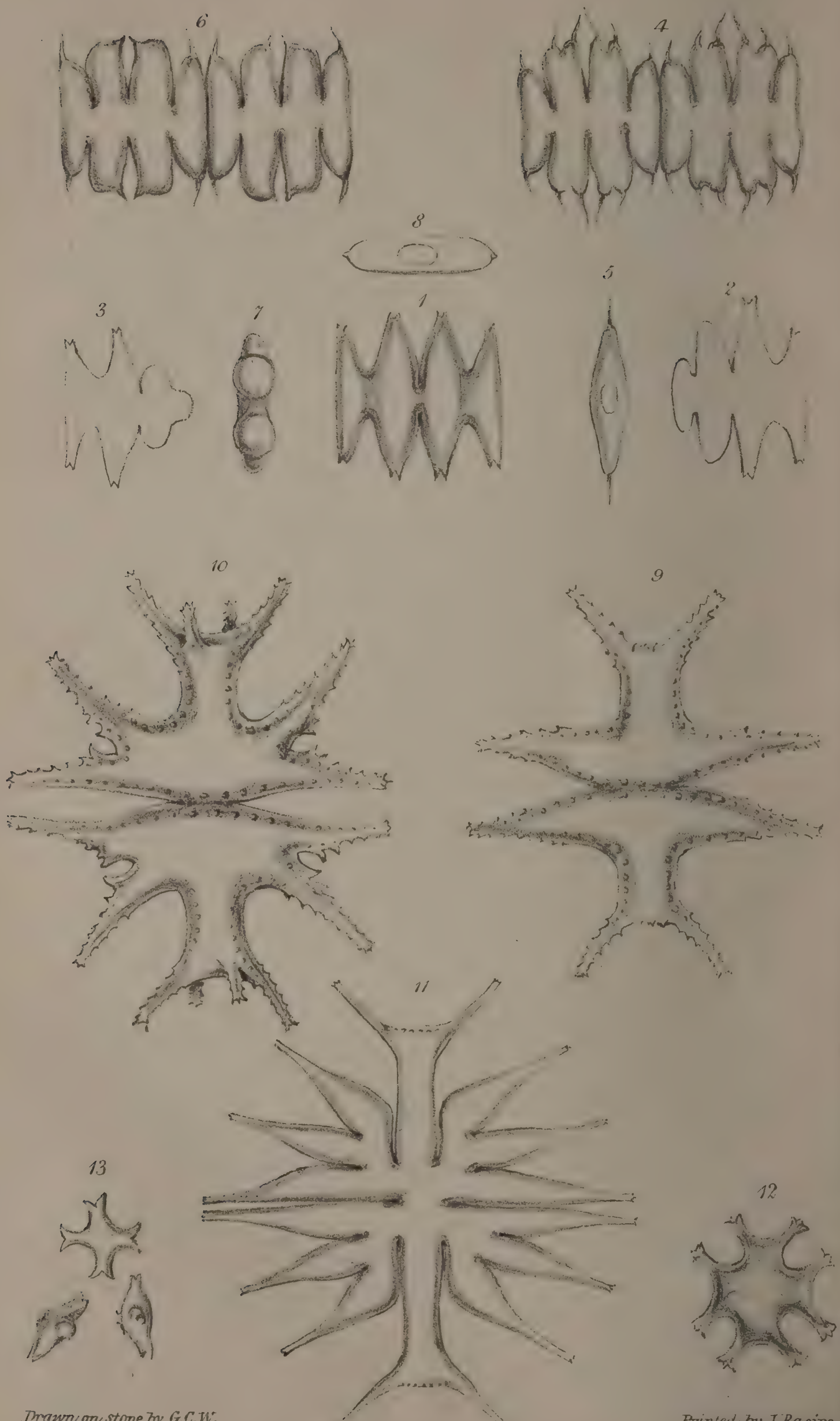
'Linnæa,' as above quoted. The absence of spines, the want of petals, and other characters show not only that it belongs to this genus, but also that it is very closely allied to the preceding and following species.

7. *Notophæna Andina*, n. sp.;—suffruticosa, humilis, inermis, procumbens; ramulis lignosis, subtortuosis, nodosis, foliosis; foliis oppositis, e gemmulis axillaribus elongatis squamosis productis, ovatis, utrinque obtusiusculis, aut basi acutioribus, integerrimis, crassiusculis, ubique parce pilosulis, supra viridibus, subtus pallide glaucis, penninerviis, petiolo brevi canaliculato pubere; stipulis imo latis, rubris, 2-fidis, ciliatis, inter se connexis; floribus paucis, subaggregatis; pedunculo 1-floro, petiolo longiore, piloso, erecto; calyce rigide puberulo, limbo 5-fido, staminibus 5 laciniis dimidio brevioribus; ovario glabro.—In Andibus Chilensibus excelsioribus.—*v. s. in herb. Hook.* (e declivitate orientali, Bridges, No. 1208).

This species is well distinguished by its procumbent spineless habit and copious aggregated foliage; its stunted proportions are consequent on its lofty Alpine growth. Its leaves grow out of elongated tubercles, or nascent branchlets, which probably in the following year become branches; these young shoots, owing to the near proximity of their axils, appear as if imbricated by the stipular appendages, and these axils bear flowers as well as leaves. The main stems also appear articulated at each node by their very conspicuous red stipules, which are similar to those of the other foregoing species. The leaves are 5 to 9 lines long, 4 to 5 lines broad, on a petiole 1 or $1\frac{1}{2}$ line long; they are discolorous, as in all the others, but with darker immersed nervures below. The peduncle is 2 lines long, the tube of the calyx $1\frac{1}{2}$ line, the segments in addition $\frac{1}{2}$ line long*.

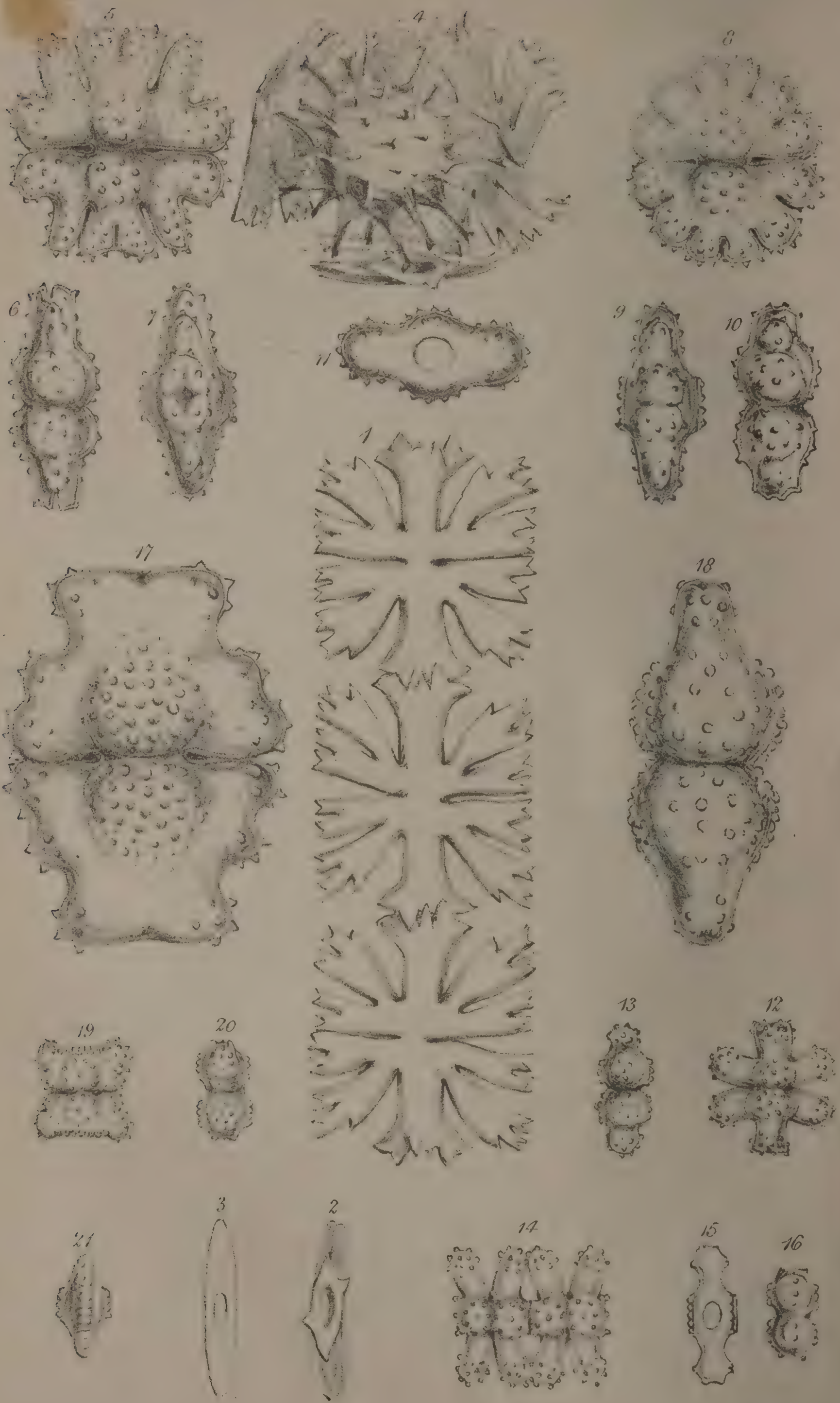
8. *Notophæna Toumatou.* Discaria Toumatou, *Raoul, Ch. Pl. Nouv. Zélande*, p. 29. Discaria Australis, var. apetala, *Hook. fil. Flor. Nov. Zeal.* i. 47;—Frutex suborgyalis, glaberrimus, ramis tortuosis, subprocumbentibus, cortice membranaceo laxo, ramulis diffusis, horizontalibus, teretibus, striatis, spinescentibus, spinis elongatis, patentibus, calloso-pungentibus; foliis parvulis, fasciculatis, e tuberculo squamoso infra spinam prodeuntibus, lineari-oblongis, obtusis aut acutis, in petiolo brevi, spathulatis, integerrimis, glaberrimis, crassiusculis, supra viridibus, nitentibus, enerviis, subtus pallide glaucis, nervis violaceis immersis; stipulis minutis, petioliferis, 2-fidis, dentibus lanceolatis, erectis, oppositis, et transversim nexis;

* This plant is drawn in Plate 37 E of the 'Contributions.'



Drawn on stone by G.C.W.

Printed by J. Basire.



Drawn on stone by G.C.W.

Printed by J. Basire.

floribus 4–6, fasciculatis, foliis intermixtis, pedunculo pubescente, erecto, calyce puberulo, limbo 4-fido, staminibus 4, erectis, laciniis dimidio brevioribus.—Nova Zelandia.—*v. s. in herb. Hook.*, east coast and interior (Colenso); Foxhill (Dr. Monro): *in herb. Mus. Paris,* Akaroa (Raoul).

This plant approaches the nearest to Ventenat's typical species, owing to its very divergent, long and stout spines, and the smallness and paucity of its leaves, in which respects they both assume more of the habit of a *Colletia.* The branchlets are quite straight, its opposite and almost horizontally-spreading spines are $\frac{3}{4}$ to 1 inch long; four or more small leaves, and often as many flowers, are almost fasciculated upon a prominent squamose gemma that issues from below the base of each spine: the leaves are 4 or 6 lines long, $1\frac{1}{2}$ line broad, on an extremely short and delicate petiole; the peduncle, the tube of the calyx, and the reflected lobes of its border are each 1 line long*.

[To be continued.]

XXXI.—*Descriptions of Desmidiaceæ from Lower Bengal.* By G. C. Wallich, M.D., F.L.S.

[With two Plates.]

[Continued from p. 197.]

Before passing from the filamentous to the non-filamentous genera, I would take the opportunity of pointing out that, however correctly the Desmidiaceæ may be separated into two great divisions, based upon the presence or absence of the filamentous character, the occurrence of that character in isolated species ought no longer to be admitted for purposes of generic separation. In confirmation of this view, I may mention having observed two examples of filamentous aggregation, occurring in isolated species belonging to genera as distinct from each other as it is possible for two genera to be, and occupying positions at the extremes of the non-filamentous division. I allude to *Micrasterias* and *Docidium.* In the first of these we certainly should not expect to meet with such a condition. It is nevertheless the normal state of a species which shall immediately be described. In the second, on the other hand, we might look for a tendency to assume the filamentous state, inasmuch as the true position of the genus is next to that of the typical filamentous genera, such as *Hyalotheca.* Nothing, I venture to say,

* A figure of this species will be shown in Plate 37 F of the 'Contributions.'

can be more incongruous than the sequence, immediately after *Sphærozosma*, of a genus containing lenticular-shaped, multilobed fronds, as is the case in *Micrasterias*; whilst genera with simple, cylindrical, or subcylindrical fronds (namely, *Tetmemorus*, *Docidium*, *Penium*, *Closterium*) hold a place directly following on complex angular forms, such as are included under *Staurastrum* and *Didymocladon*.

The occurrence of these isolated filamentous species shows that, however valid may be the character derived from it for purposes of specific distinction, it affords no good basis for generic separation, when taken by itself.

Docidium asperum, which also occurs in the filamentous form in Bengal, has on this ground alone been elevated into a distinct genus by De Bary; and of such importance is the character generally considered, that some of the most eminent authorities have deemed it necessary thereupon to transfer *D. asperum* to the true Confervoid Algæ. Unless they are prepared to transfer the entire genus, the removal of the isolated species must be cancelled; for the Bengal filamentous *Docidium* is closely allied to *D. coronatum*, Ehr., and constitutes as distinct a form as *D. clavatum* or *D. Ehrenbergii*. I would mention, in order to prevent misapprehension on this subject, that the occasional coherence of a few fronds, under favouring circumstances, as is often seen in *Cosmarium moniliferum* and some other species, is quite distinct from the normally filamentous condition to which reference is here made.

Synopsis of the Genera.

*** Sporangia spinous or tuberculate. Frond distinctly constricted at the junction of the segments.*

8. Holocystis. Frond much compressed or lenticular. Segments horizontally lobate.
9. Micrasterias. Frond lenticular or tabular, lobate. Lobes dentate, or inciso-dentate.
10. Euastrum. End view of segments oblong or sinuate. Segments lobate or sinuate. Lobes emarginate or incised, and generally furnished with inflated granular protuberances.
11. Cosmarium. Frond simple. Segments entire.
12. Xanthidium. Segments entire, with symmetrically arranged processes or spines.
13. Staurastrum (including *Arthrodesmus*). End view compressed, angular, or radiate. Segments mucronate, spinous, or with dentate projections.
14. Didymocladon. Segments angular, with geminate or alternate dentate projections or spines.

*** *Sporangia smooth. Fronds greatly elongated. Joints with slight or no constriction between the segments.*

15. Tetmemorus. Frond straight, constricted at the centre, and notched at the extremities.

16. Penium. Frond straight, with very faint or no constriction.

17. Docidium. Frond greatly elongated, straight, constricted at centre. Ends truncate.

18. Closterium. Frond crescentic or arcuate. Without a definite constriction.

**** *Fronds composite or arranged in clusters. Sporangia unknown.*

19. Scenedesmus. Cells oblong or fusiform, placed side by side in one or more rows.

20. Ankistrodesmus. Cells aggregated into faggot-like bundles.

***** *Cells arranged on the same plane, around a common centre.*

21. Pediastrum. Cells arranged in a stellate or radiate series. The outer series mucronate, dentate, or bidentate.

8. *Holocystis*, Hass.

Frond lenticular. Segments horizontally lobate.

1. *H. oscitans*, Ralfs. Frond divided by an angular constriction into two horizontal bilobate segments. Lobes fusiform or subfusiform.

Micrasterias oscitans, Ralfs, British Desmid. 1845.
Euastrum pinnatifidum, Kütz. 1845.
Euastrum, No. 7, Bailey, Amer. Bacil. pl. 1. fig. 25, 1841.

As every gradation between the form presenting the lobes fusiform and inflated, and that in which the margin of the terminal lobe is straight or even hollowed, is constantly to be met with, I have ventured to set aside the unimportant distinctions derived only from size or colour, and to unite, under one head, *Micrasterias oscitans*, Ralfs, and *M. pinnatifida*, Kütz. The intermediate varieties occur in abundance in Lower Bengal; and in no instance have I detected evidence of their being immature states of two distinct species, as suggested by Ehrenberg and Meneghini; on the contrary, I have found proof of their being true varieties of the same in the fact of their dividing.

The two figures of *Holocystis oscitans* in Hassall's 'Freshwater Algæ' (pl. 90. figs. 3 & 4) evidently depict two very distinct species, neither of which accords with the characters of *Micrasterias oscitans*, Ralfs. Fig. 3, which is referred to in the explanatory index to the plates, with a query as to its being the young state of *M. Crux-melitensis*, is not alluded to in the letter-press,

but is unquestionably a small variety of the species described by Kützing as *Euastrum incisum* (Phyc. Germ. p. 134), and properly belongs to the present genus.

Micrasterias quadrata, Bailey ('Smithsonian Contrib., Microsc. Observ. in South Carolina, &c.'), appears to be merely a large variety of *M. oscitans*, Ralfs.

Length ·0021″; breadth ·0021″.

Lower Bengal.

Plate XIII. fig. 1. Front view. Figs. 2 & 3, showing the development of the terminal lobe.

2. *H. incisa*, Kütz. Lobes divided by a deep incision. Basal lobe linear or slightly sinuate, truncate; its extremities emarginate; both angles furnished with a mucro. Terminal lobe fusiform, mucronate.
Micrasterias incisa, Kütz.

This species differs from *H. oscitans* in having abruptly truncate, linear basal lobes; in the latter being emarginate, and having both angles mucronate. The frond is quadrilateral, the terminal lobe being nearly as long, but not so large and turgid, as the basal one. The constriction between the segments and lobes is deep, and slightly gaping.

Length ·0017″; breadth ·0020″.

Plate XIII. fig. 4. Front view of fronds dividing. Fig. 5. Basal view.

H. incisa, var. *β*. This variety differs only in having the extremities of the basal lobes truncate, but not emarginate. The outer angle is rounded off, whilst the inner only is furnished with a mucro.

In both forms, the mucronate spines vary in length in the two lobes, and, in different specimens, from mere conical projections to spines equalling the diameter of the lobes in length.

Dimensions as in the former case.

Lower Bengal, 1855.

Plate XIII. fig. 6. Front view of frond dividing. Fig. 7. Side view. Fig. 8. Basal view.

9. *Micrasterias*, Ag.

Frond lenticular or tabular, deeply divided into two lobate segments. Lobes dentate, or inciso-dentate.

* *Basal lobes entire.*

1. *M. expansa*, Bailey.
M. arcuata, Bailey (Smithson. Cont., Microsc. Researches in S. Carolina and Georgia).

The entire character of the basal lobe in this species denotes the link between the last and the present genus.

Var. *γ*, in like manner with *M. arcuata*, Bailey, is only a

variety of *M. expansa,* none of the differences amounting to anything more than those of degree. The furcate processes are longer, the margins are serrate, the extremities of the basal lobes and furcations are tridentate instead of being bidentate, and the whole frond is somewhat longer. The basal lobe is broadly fusiform, and gradually tapers to subacute apices. The terminal lobe is short and linear as far as the furcation, and, with the basal lobe, is furnished with a submarginal row of short stout spines.

Length ·0050″; breadth ·0045″.

Lower Bengal, 1855.

Plate XIII. fig. 9. Front view.

** *Terminal lobes bifurcate. Furcations at right angles to each other.*

2. *M. morsa,* Ralfs*.
M. Baileyi, Ralfs.
M. ringens, Bailey.

Var. δ. Frond oblong. Segments three-lobed. Lateral lobes deeply emarginate, inciso-serrate. Terminal lobe bifurcate.

On comparing the general outline and structure of var. δ with what we find in *M. morsa,* as described and figured by Mr. Ralfs, it will, I think, be admitted that, however distinct, at first sight, the Bengal form may appear to be, it presents no distinct character of sufficient importance to demand its elevation into a separate species. As regards *M. Baileyi* and *M. ringens,* it is difficult to speak so confidently; for in these we only meet with the first-named ground for amalgamation. This is, however, by no means unimportant; and, coupled with the fact that in 'The American Journal of Science and Arts' (vol. xli. No. 2) Prof. Bailey has figured, although somewhat rudely and without any appended description, a form exhibiting the bifurcate peculiarity in question, previously obtained from the same habitat, and otherwise agreeing with the general characters of the variety under notice, it appears highly probable that *M. ringens* and *M. Baileyi* are identical with each other, and only constitute a variety of *M. morsa.*

Var. δ is distinguished from *M. morsa* by its narrow lateral lobes, in their being deeply emarginate, and in the terminal lobe being much exserted. But it will be seen that these constitute only differences as to the degree of certain features, which admit of variation from climatic or accidental causes. So long as such

* In the list of errata to the 'British Desmidieæ,' the following instructions occur:—"For *M. morsa* read *M. americana,* Ehr., and add the following synonym: *Euastrum americanum,* Ehr., Verbreitung und Einfluss des Mikros. Lebens in Süd- und Nord-Amerika, t. 4. f. 15, 1843." The characters, however, remain unaltered.

differences are permitted to exercise an undue weight, we shall never be able to disencumber our lists of the multitude of fictitious species they contain. I would particularly draw attention to the manner in which species have been extended in the genus I am now discussing,—upon the slender basis of a notch or a tooth more or less; whereas, in some of the figures of the same species, and, in some cases, actually in the two segments of the same frond, differences quite as great or greater are visible. As it at present stands, the genus *Micrasterias* numbers upwards of twenty species, which I firmly believe are reducible to less than half that number, without infringing on a single reliable distinctive character.

In the figures of *M. morsa* given by Mr. Ralfs, as also in that given by Professor Bailey, to which allusion has been made, and which was referred to as an *Euastrum*, the extremities of the furcate terminal lobe are made to appear bifid. Mr. Ralfs's description, moreover, would show that such was his view of its structure. It may be somewhat rash in me to offer an opinion as to the bifid appearance being due to the compression of the furcate processes, which have been described as being placed at right angles to the plane of the frond. Nevertheless, having repeatedly seen the same appearance presented, and having always been able, by careful adjustment of the microscope, to trace these processes to their independent base, I venture to believe that the structure is the same in each of these forms. In one of Mr. Ralfs's figures of *M. morsa*, the true character is actually given in one half of the terminal lobe, whilst it is not so in the other.

Mr. Ralfs states that "*M. morsa* differs from *M. Crux-melitensis* in the bifid angles of the end lobes, and in the concave and serrated margin, as well as the less divided state of the lateral lobes." But the same author gives the characters of *M. Crux-melitensis* as follows: "Frond rotundato-elliptic; segments sub-five-lobed; lobes bifid, subdivisions short and bidentate at the apex," and adds that the frond is about the same size as that of *M. furcata*, and similarly divided, but the incisions are less deep, the subdivisions stouter and less divergent, and their extremities are rather bidentate than forked. In Hassall's 'Freshwater Algæ,' p. 387, it is stated that the frond of the true *M. Crux-melitensis* is oval rather than circular, and each segment is three-lobed instead of five-, and the lobes themselves are not approximate, but divergent. As figured by Mr. Ralfs, *M. Crux-melitensis* is quite distinct from this form, the frond being, moreover, perfectly smooth; whereas the figure of *M. morsa* shows that its structure is punctate or granular. For *M. Baileyi* the characters given by Mr. Ralfs are: "Frond granulated; segments 3-lobed; lobes bipartite, end one much exserted." "*M. Baileyi* is allied to *M. furcata* and *M. Crux-melitensis*; the

frond, however, is minutely granulate, the segments are only three-lobed, and the end lobe is more exserted than it is in those species. The basal lobes are deeply partite, the end one is merely sinuated. All the subdivisions are bidentate at the apex." And lastly, *M. ringens* is thus described by Prof. Bailey ('Smithsonian Cont., Microscop. Observations in South Carolina and Georgia,' p. 37): "Oblong; segments 3-lobed, coarsely granulated near the edge; basal lobes subdivided by a deep notch into two rather broad and obtuse or slightly bidentate projections; terminal lobes exserted, emarginate; extremities bidentate or obtuse. Resembles *M. Baileyi*, Ralfs, but is larger, its divisions less slender, and with the granulations differently placed."

In var. γ, the lateral lobes are nearly horizontal, the outer sub-lobe being exserted from the basal line of the segment, so as to give a gaping appearance to the emarginate portion. The terminal lobe is stout; and from the base of its bifurcations, and placed diagonally to each other, on opposite surfaces of the frond, are given off the two additional processes referred to. It is possible that, owing to the doubling down of these processes (which it will be observed are perpendicular to the plane of the frond), the impression of the ordinary processes being bifid at their extremities may have arisen, as is stated to be the case in the description of *M. morsa* (British Desmid. p. 74). The apices of the furcations, as well as the extremities of the lateral sub-lobes, are elongated and tridentate.

Length ·0060″; breadth ·0048″.

Lower Bengal, 1855.

Plate XIII. fig. 10. Front view.

*** *Lateral lobes deeply and equally tripartite. Subdivisions plane.*

3. *M. alata*, n. s. Frond rather longer than broad. Segments deeply 3-lobed; lateral lobes deeply and equally tripartite; terminal lobe furcate, and much exserted.

This species appears to hold an intermediate position between the American species *M. Torreyi*, described in the Appendix to the 'British Desmidieæ,' and *M. furcata*.

The deeply and equally tripartite form of the lateral lobes distinguishes this very graceful species from all the allied ones. The inner half of the terminal lobe, which is constructed on the same plan as that of *M. furcata*, is very slender, and is received into a deep notch formed by the two lateral lobes. Its furcate ends are delicate, elongated, and project obliquely outwards, without any perceptible curve. At the base of the furcation, the margin is minutely punctate. The rest of the frond is perfectly smooth. The lateral lobes are attached to the base of the segment by a narrow isthmus, and at once expand to their full

breadth, in close apposition with the lower half of the terminal lobe. The two inner subdivisions are directed radially. The outer is abruptly reflected towards the basal line of the segment, and thus imparts the alate character for which the frond is so conspicuous. The subdivisions of the lateral lobe, at first slightly inflated, gradually taper to subacute apices, which, in like manner with the apices of the terminal lobe, are tridentate.

Length ·0058″; breadth ·0056″.

Lower Bengal, 1855.

Plate XIII. fig. 11. Front view.

**** *Lateral lobes inciso-dentate, or dichotomously incised.*

4. *M. furcata*, Ag. This species is very abundant, and occurs in every state intermediate between the typical one and its variety commonly described under the specific name of *M. Crux-melitensis.*

5. *M. denticulata*, Bréb.
M. rotata, Grev.

These two forms are met with somewhat sparingly. As far as I can judge, however, they present no character of sufficient value to denote specific difference. The mere rounding off of the dentate angles is surely too trifling a distinction to found even a variety upon. The tendency to these slight modifications in form has already been dwelt upon in describing the species of *Aptogonum.*

6. *M. foliacea*, Bailey.

Var. β. Fronds quadrangular, forming elongated filaments. Segments 3-lobed. Lateral lobes dichotomously incised, with a dentate process next the terminal lobe, which is dentato-emarginate.

Although the filamentous character of the Bengal form, and the peculiar structure of its terminal lobe, do not tally with the description given by Mr. Ralfs of *M. foliacea*, the occurrence of the tooth-like projection next the terminal lobe, and the general resemblance of the two forms, induce me to refer it to that species. Indeed, judging from the very imperfect representation of *M. foliacea* supplied to Mr. Ralfs by Prof. Bailey (British Desmid. p. 210), it would appear probable that the minute peculiarities of the one had in reality escaped observation in the other.

The characters of *M. foliacea* as given (*loc. cit.*) are as follows: "Frond subquadrate. End lobe narrow, with emarginate angles. Lateral lobes inciso-dentate, with a short rounded tooth-like

projection next the end lobe. The middle segment is nearly simple and emarginate."

The prominent feature of var. β consists in its largely developed, triangular terminal lobe, the base of which is directed outwards, emarginate at its angles and centre, and furnished with two short stout teeth placed obliquely to each other, as in *M. Baileyi*. The central emargination of this lobe is deep and rectangular; and the entire lobe projects but very slightly beyond the apices of the lateral ones. The margins of the filament are parallel and direct; the fronds tabular, and divided by a very deep constriction into two dichotomously incised segments, the ultimate subdivisions of which are emarginate.

In the Bengal variety, the "tooth-like projections" next the terminal lobe are acutely angular, instead of being rounded; and, as in the case of *Onychonema*, the projecting processes, by which cohesion is either secured or increased, overlap each other alternately in adjacent fronds.

M. foliacea, var. β, occurs abundantly in some localities, and invariably in the condition described. Seen under the microscope, the rich emerald-green filament is, without exception, the most beautiful of the Desmidiaceæ.

Length of frond ·0033″; breadth ·0028″. Diameter of sporangium, exclusive of spines, ·0018″.

Lower Bengal, 1855.

Plate XIV. fig. 1. Front view in filament. Fig. 2. End view. Fig. 3. Basal view of segments. Fig. 4. Sporangium.

***** *Frond cruciform.*

7. *M. cruciata*, n. s. Frond cruciform, divided by a concave notch into two dichotomously-furcate, symmetrically-lobed segments.

The two curious forms placed under this section are so anomalously constructed as to render it doubtful whether they really belong to the genus under notice. The absence of all trace of a central suture is remarkable; and in this respect they resemble some species of *Penium*. *M. cruciata* cannot be better described than by likening it to the four terminal lobes of *M. furcata* united together by their bases, the intermediate angles being completely rounded off. Like the lobe of that species, each extremity is furcate; the branches curved inwards. The apices are tridentate.

Diameter of frond ·0019″.

Lower Bengal, 1855.

Plate XIII. fig. 12. Front view.

8. *M. pusilla*. Frond cruciform, divided by a concave notch into

two broad emarginate lobes, the angles of which are inflated and bidentate.

In like manner with the former species, this minute form presents no visible central suture, but, on the contrary, is somewhat inflated at the central portion. Both may be young states of other species; but they did not occur in sufficient number to enable me to decide the point. They are therefore placed provisionally under *Micrasterias.*

Diameter ·0010″.

Lower Bengal, 1855.

Plate XIII. fig. 13. Front views.

10. *Euastrum,* Ehr.

Frond compressed, deeply divided into two segments, which are sinuate, lobed, emarginate, or furnished with inflated, often granulated, protuberances.

* *Terminal lobe cuneate, included between the lateral lobes.*

1. *E. verrucosum,* Ehr.

Var. β. Segments closely approximate along the entire bases. Outer subdivision of lateral lobe parallel with the margin of the terminal one, from which it is separated by a deep but narrow notch. Lobes subradiate.

This variety differs from the typical *E. verrucosum* in having the margin of the terminal lobe straight and deeply incised, in not being quite so turgid at the base of the segments, and in wanting the terminal inflation represented as being present in the British species. But in all other points the structure is sufficiently similar to indicate that it is only a variety of that form.

Length ·0031″; breadth ·0029″.

Lower Bengal, 1855.

Plate XIV. fig. 5. Front view. Fig. 6. Side view. Fig. 7. End view.

2. *E. orbiculare,* n. s. Frond orbicular. Lateral segments divided into two equal portions by a deep incision. Lobes and sub-lobes radiate.

The orbicular outline of this species at once distinguishes it from its allies, and more especially from the two forms of the last-mentioned species. The terminal lobe, which is closely embraced by the lateral sub-lobes, is deeply incised, and, coupled with the incisions of the lateral lobes, imparts to the entire frond a crenate and radiate character.

The side- and end-views are very similar to those of var. β of *E. verrucosum.*

This species interferes with the distinction laid down by Mr. Ralfs (British Desmid. p. 78) between *Euastrum* and *Micrasterias*, inasmuch as the lobes are most distinctly incised, and radially arranged.

Length ·0028″; breadth ·0025″.

Lower Bengal, 1855.

Plate XIV. fig. 8. Front view. Fig. 9. End view. Fig. 10. Side view. Fig. 11. Basal view of segment.

3. *E. crassum*, Bréb.

** *Segments sinuated; terminal lobe exserted and united with the basal lobe by a distinct neck.*

4. *E. numerosum.*
E. affine, Ralfs.

The transverse views of these two forms merge one into the other.

5. *E. didelta*, Turp.
E. ansatum, Ehr.

The sporangium of these two varieties is tuberculate.

*** "*Frond without a distinct terminal lobe, and frequently with a process, an acute angle,*" *or an inflation* "*at the corners of the terminal portion.*"

6. *E. rostratum*, Ralfs.

Var. β. Frond oblong. Segments sublobate, their lateral margins sinuate. Terminal margin notched and angular.

The Bengal varieties occur in every intermediate form between *E. elegans*, which merges into *E. rostratum* on the one side, and the small subangular *E. binale* on the other; the latter being indistinguishable from a variety of *Cosmarium Meneghini*. Indeed it is far from improbable that *E. elegans*, *E. binale*, and *E. rostratum* are only varieties of one typical species.

7. *E. turgidum*, n. s. Frond large. Segments broadly cuneate, truncate, with a large central inflation. Terminal margin straight.

As seen in the front view, the general outline of this species resembles that of the immature state of the large variety of *Xanthidium armatum*. It is distinguished from it, however, by the presence of the large central granulate inflation, the existence of a minute terminal notch, and by its not presenting the characteristic funnel-shaped processes which are distributed symmetrically upon the frond in that species.

It also bears some resemblance to the species recently discovered in Ireland by the Rev. R. N. Dixon, and described under

the new generic name of *Tetrachastrum* in the 'Nat. Hist. Review' (vol. vi. No. 4. p. 464); but, if a mature form, the entire absence of any inflated protuberance, or terminal notch, would seem sufficient to distinguish the latter from the present species, and to render it conformable, in all essential characters, to *Holocystis oscitans*, Hassall.

In the side view, the central inflated portion presents an irregular granulated outline, and the segments are pyriform. End view broadly elliptical, with the inflated portion granulated and the angles furnished with several stout conical projections.

The lateral margins, in the front view, are sinuate, the prominent portions presenting the conical projections already referred to.

Length ·0050″; breadth ·0038′.

Lower Bengal, 1855.

Plate XIV. fig. 17. Front view. Fig. 18. Side view.

8. *E. clepsydra*, n. s. Frond quadrangular. Segments broadest at the terminal margin, and acutely constricted on their lateral margins. Angles rounded.

Frond rather longer than broad, much inflated. Terminal margin straight, and crenate between the rounded angles. Surface granulated.

Side view oblong, truncate, the extremity angular and subdendate. The central constriction marked by a sinuosity. End view elliptical.

Length ·0013″; breadth at outer margin ·0014″. Ditto at constriction ·0009″.

Lower Bengal, 1855.

Plate XIV. fig. 19. Front view. Fig. 20. Side view. Fig. 21. End view.

**** *Lateral lobes distinct, entire.*

9. *E. commissurale*, Bréb. Frond divided by a somewhat gaping but deep constriction into two segments. Lateral lobes horizontal, entire. Terminal lobe direct, slightly emarginate, or notched. Lobes with central and terminal granular protuberances.

Cosmarium commissurale, Bréb.

Although not in possession of authenticated specimens of *Cosmarium commissurale*, Bréb., from very careful comparison of the truncated Bengal variety with the description and figures of that species given by Mr. Ralfs (British Desmid.), there can, I believe, be little doubt of their identity. The occurrence of the other variety with a large, somewhat inflated, angular terminal lobe, as also the presence, on that and the basal lobes, of the

"inflated granular protuberances," render the transfer of both varieties to *Euastrum* inevitable.

Unless a strict line of separation, dependent on these characters, is maintained between these two very closely allied genera, I need hardly observe that it becomes impossible to assign correct positions to the numerous varieties bordering on *E. elegans* and *E. binale,* on the one hand, and on *Cosmarium quadratum* and *C. Meneghini* on the other.

In side view, each segment presents one central and two terminal granular inflations, united by a constricted neck. The frond is compressed. The ends of the basal lobes are rounded, whilst those of the terminal ones are truncate, angular, or subangular,—the granular bodies being confined to the outer third of each lobe.

Var. *β*. The terminal lobe almost obsolete. Seen in the end view, the two segments appear octagonal, and united by one of their sides.

In this case, also, the fronds have been observed undergoing division. The varieties are therefore mature forms.

Length ·0018″; breadth ·0016″.

Var. *β*. Length ·0010″; breadth ·0018″.

Lower Bengal.

Plate XIV. fig. 12. Front view. Fig. 13. Side view. Fig. 14. Front view of var. *β*. Fig. 15. Basal view of segment. Fig. 16. Side view.

[To be continued.]

XXXII.—*On the Nomenclature of the* Foraminifera. By W. K. Parker, M. Micr. Soc., and T. R. Jones, F.G.S.

[Continued from p. 183.]

Part IV.—*The Species enumerated by Lamarck.*

The Lamarckian species of *Foraminifera,* though treated as microscopic Cephalopods, and represented by very bare engravings, are recognizable, especially by those who have carefully examined the Rhizopodous fauna of the Eocene Tertiary beds of France (particularly the "Calcaire grossier"), whence Lamarck obtained his specimens. As these comprise several important generic and specific types, as well as some peculiar varietal conditions, Lamarck, in naming them, supplied for the *Foraminifera* several generic names (based, however, on ill-defined grounds) which have been adopted by subsequent naturalists, the majority of his binomial appellations being serviceable.

In the 'Système des Animaux sans Vertèbres' (1801), Lamarck enumerated a few forms (some being grouped as Molluscs, others as Corals). All but one of these are well known on account of subsequent notices by himself and others.

In the 'Annales du Muséum' (1804), vol. v. p. 179, p. 237, and p. 349, Lamarck more fully described some *Foraminifera* in his 'Suite des Mémoires sur les Fossiles des Environs de Paris.' Most of these were figured in the Ann. Mus. vol. viii. pl. 62. figs. 7–16, and vol. ix. pl. 17. figs. 1–6. Nearly all these figures were copied in the 'Tableau Encyclopédique et Méthodique' (Part 23, 1816), pl. 465. figs. 2–4, 6–8; pl. 466. figs. 1–8; and pl. 469. figs. 2, 3. In the 'Histoire Naturelle des Animaux sans Vertèbres' (1816–22), vols. ii. & vii., Lamarck again described his species (with one or two exceptions), and added two others, arranging the whole under a new classification, which, however, being (like the previous arrangement) based on the supposed Cephalopodous character of these little shells, is of no account.

In the 'Tableau Encyclop. Méth.' (pl. 466–470), others besides those first described by Lamarck are figured; namely, a few from older authors, and several of the forms figured and described by Fichtel and Moll: but as little need be said respecting these besides restoring to them their original trivial names (many of which have been twice altered by Lamarck,—once in the 'Tabl. Encycl. Méth.,' and again in the 'Anim. s. Vert.'), we shall treat of them by themselves, after having noticed in detail the real Lamarckian species.

The figures given by Lamarck in the 'Annales du Muséum,' used also in the 'Tabl. Enc. Méth.,' were again and again copied by others; especially in Parkinson's 'Organic Remains of a Former World' (1811), pl. 11; Crouch's 'Illustrated Introduction to Lamarck's Conchology' (1827), pl. 20 & 22; Brown's 'Conchologist's Text-Book' (1833), pl. 10; and Brown's 'Elements of Fossil Conchology' (1843), pl. 1, 2, & 3.

The following are consecutive lists of the *Foraminifera* described and figured by Lamarck in his several works —

'Système des Animaux sans Vertèbres.' Par J. B. Lamarck. 8vo. Paris, 1801.

	Lamarck's Names.	*Corrected Names.*
1. p. 101.	Nummulites lævigata....	Nummulina lævigata, *Lam.*
2. p. 376.	Orbitolites complanata ..	Orbitolites complanata, *Lam.*
3. p. 376.	Siderolites calcitrapoïdes .	Calcarina Spengleri, *Gmel.*
4. p. 401.	Rotalites tuberculosa	Rotalia trochidiformis ?, *Lam.*
5. p. 402.	Oveolites Margaritula ..	Ovulites Margaritula, *Lam.*

'Annales du Muséum,' vol. v. (1804).

	Page.	No.	*Lamarck's Names.*	*Corrected Names.*	
6.	183.	1.	Discorbites vesicularis	Rotalia Turbo, *d'Orb.*, var. vesicularis, *Lam.*	
7.	184.	1.	Rotalia trochidiformis	Rotalia Turbo, *d'Orb.*, var. trochidiformis, *Lam.*	
8.	..	2.	—— lenticularis	Rotalia Turbo, *d'Orb.*, var. lenticulina, *Lam.*	
	185.		— var. *β.* (sinistrorsa)		
9.	..	3.	—— depressa	Truncatulina depressa, *Lam.* [*Type*, Planorbulina farcta, *F. & M.*]	
10.	..	4.	—— Discorbula	Rotalia Beccarii, *Linn.*	
11.	187.	1.	Lenticulites planulata	Nummulina planulata, *Lam.*	
12.	..	2.	—— variolaria......	Nummulina planulata, *Lam.*, var. variolaria, [*Lam.*	
13.	188.	3.	—— rotulata	Cristellaria Calcar, *Linn.*, var. rotulata, *Lam.*	
1.	241.	1.	Nummulites lævigata	Nummulina lævigata, *Lam.*	
14.	..	2.	—— globularia	Nummulina lævigata, *Lam.*, var. globularia, [*Lam.*	
15.	..	3.	—— scabra	Nummulina lævigata, *Lam.*, var. scabra, *Lam.*	
16.	242.	4.	—— complanata	Nummulina complanata, *Lam.*	
17.	243.	1.	Lituolites nautiloidea	Lituola nautiloidea, *Lam.*	
18.	..	2.	—— difformis	Lituola nautiloidea, *Lam.*, var. difformis, *Lam.*	
19.	245.	1.	Spirolinites depressa.	Peneroplis planatus, *F. & M.*	
20.	..	2.	—— cylindracea	Peneroplis planatus, *F. & M.*, var. cylindracea, [*Lam.*	
21.	..		—— var. *β.* (recta) ..	Clavulina Clavulus, *Lam.* [*Type*, Valvulina triangularis, *d'Orb.*]	
22.	351.	1.	Miliolites ringens....	Biloculina ringens, *Lam.*	*Type*, Miliola Seminulum, *Linn.*
23.	..	2.	—— Cor-anguinum .	Triloculina cor-anguinum, *Lam.*	
24.	..	3.	—— trigonula	Triloculina trigonula, *Lam.*	
25.	352.	4.	—— planulata var. *β.* (turgidula) var. *γ.* (planissima)	Spiroloculina planulata, *Lam.*	
26.	..	5.	—— Saxorum	Quinqueloculina Saxorum, *Lam.* & varr.	
27.	353.	6.	—— opposita		
28.	..	7.	—— birostris		
29.	354.	1.	Renulites opercularia	Vertebralina striata, *d'Orb.*, var. opercularia, *Lam.*	

'Tableau Encyclopédique et Méthodique des Trois Règnes de la Nature. Vingt-troisième Partie. Mollusques et Polypes divers.' Par M. Lamarck. 4to. Paris, 1816.

	Plate.	fig.	*Lamarck's Names.*	*Corrected Names.*
39.	465.	2 *a*, *b*, *c*.	Orthocera Raphanus....	Nodosaria Raphanus, *Linn.*
40.		3 *a*, *b*, *c*.	Orthocera Legumen....	Vaginulina Legumen, *Linn.* [*Type*, Nodosaria Raphanus, *Linn.*]
41.		4 *a*, *b*, *c*.	Nodosaria Radicula	Nodosaria Radicula, *Linn.*
17.		6	Lituola nautiloides	Lituola nautiloidea, *Lam.*
20.		7 *a*, *b*, *c*.	Spirolina cylindracea....	Peneroplis planatus, *F. & M.*, var. cylindracea, *Lam.*
29.		8	Renulites opercularis....	Vertebralina striata, *d'Orb.*, var. opercularia, *Lam.*
18.	466.	1 *a*, *b*.	Lituola difformis	Lituola nautiloidea, *Lam.*, var. difformis, *Lam.*
20.		2 *a*, *b*.	Spirolina cylindracea	Peneroplis planatus, *F. & M.*, var. cylindracea, *Lam.*
21.		3 *a*, *b*.	Nodosaria Clavulus	Clavulina Clavulus, *Lam.* [*Type*, Valvulina triangularis, *d'Orb.*]

	Plate.	fig.			
17.	466.	4	Lituola nautiloides	Lituola nautiloidea, *Lam.*	
13.		5	Lenticulites rotulata	Cristellaria Calcar, *Linn.*, var. rotulata, *Lam.*	
10.		6 *a, b.*	Discorbula Ariminensis ..	Rotalia Beccarii, *Linn.*	
6.		7 *a, b, c.*	Discorbites vesicularis ..	Rotalia Turbo, *d'Orb.*, var. vesicularis, *Lam.*	
7.		8 *a, b.*	Rotalites trochidiformis..	Rotalia Turbo, *d'Orb.*, var. trochidiformis, *Lam.*	
42.		9 *a–d.*	Pulvinulus repandus	Rotalia repanda, *F. & M.*	
43.		10 *a–d.*	Pulvinulus asterisans ..	Nonionina asterizans, *F. & M.*	
44.	467.	1 *a, b, c.*	Cristellaria planata	Peneroplis planatus, var. *a.*, *F. & M.*	
45.		2 *a, b, c.*	Cristellaria dilatata	Peneroplis planatus, var. *β*, *F. & M.*	
46.		3 *a–d.*	Cristellaria Cassis	Cristellaria Cassis, var. *a*, *F. & M.*	*Type*, Cristellaria Calcar, *Linn.*
47.		3 *e–g.*	Cristellaria producta	—— Cassis, var. *β*, *F. & M.*	
48.		4 *a, b.*	Cristellaria producta	—— Cassis, var. *γ*, *F. & M.*	
49.		4 *c, d.*	Cristellaria papilionacea .	—— Cassis, var. *δ*, *F. & M.*	
50.		5 *a–c.*	Cristellaria undata	—— Cassis, var. *ε*, *F. & M.*	
51.		6 *a–c.*	Cristellaria Galea	—— Galea, *F. & M.*	
52.		7 *a–c.*	Cristellaria acutauricularis	—— acutauricularis, *F. & M.*	
53.	468.	1 *a–d.*	Orbiculina nummata	Orbiculina adunca, var. Orbiculus, *F. & M.*	
54.		2 *a, b, c.*	Orbiculina adunca	Orbiculina adunca, *F. & M.*	
55.		3 *a–d.*	Orbiculina angulata	Orbiculina adunca, var. angulata, *F. & M.*	
56.	469.	1 *a–f.*	Melonites sphærica	Alveolina Melo, var. *α*, *F. & M.*	
57.		1 *g, h.*	Melonites sphæroidea ..	Alveolina Melo, var. *β*, *F. & M.*	
23. 24.		2 *a, b, c.*	Miliolites Cor-anguinum	Trilocula trigonula, *Lam.*	*Type*, Miliola Seminulum, *Linn.*
26. 27.		3 *a, b, c.*	Miliolites Saxorum	Quinqueloculina Saxorum, *Lam.*	
58.	470.	1 *a, b, c.*	Vorticialis strigillata....	Polystomella crispa, *Linn.*, var. craticulata, *F. & M.*	
59.		2 *a, b, c.*	Vorticialis depressa	Polystomella crispa, *Linn.*, var. strigilata, subvar. *a*, *F. & M.*	
60.		3 *a, b.*	Vorticialis marginata ..	Polystomella crispa, *Linn.*, var. strigilata, subvar. *β*, *F. & M.*	
3.		4 *a–k.*	Siderolites calcitrapoïdes	Calcarina Spengleri, *Gmel.*	
61.	471.	1 *a, b.*	Nummulites lenticularis .	Nummulina lenticularis, var. *a*, *F. & M.*=? N. planulata, *Lam.*, var.	
62.		2 *a, b.*	Nummulites Mammilla ..	Nummulina Mamilla, *F. & M.* = ? N. planulata, *Lam.*, var.	
5.	479.	7.	Ovulites Margaritula....	Ovulites Margaritula, *Lam.*	
30.		8.	Ovulites elongata	Ovulites Margaritula, var. elongata, *Lam.*	

'Histoire Naturelle des Animaux sans Vertèbres.' Par M. le Chevalier de Lamarck. 7 vols. 8vo. Paris, 1815–22.

Vol. ii. 1816. Page.	No.	*Lamarck's Names.*	*Corrected Names.*
31. 189.		Dactylopora cylindracea	Dactylopora Bambusa, *P. & J.*, var. cylindracea, *Lam.*
5. 194.	1.	Ovulites Margaritula ..	Ovulites Margaritula, *Lam.*
30.	2.	—— elongata	O. Margaritula, var. elongata, *Lam.*
32. 196.	1.	Orbulites marginalis	Orbitolites complanata, *Lam.*
2.	2.	—— complanata	

	Page.	No.		
33.	197.	3.	Orbulites lenticulata ..	Orbitolina concava, var. lenticulata, *Lam.*
34.		4.	—— concava	Orbitolina concava, *Lam.*
35.		5.	—— macropora......	Orbitolites complanata, var. macropora, *Lam.*
36.		6.	—— Pileolus........	Orbitolina concava, var. Pileolus, *Lam.*

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	Page.	No.	*Lamarck's Names.*	*Corrected Names.*	
39.	593.	1.	Orthocera Raphanus ..	Nodosaria Raphanus, *Linn.*	
63.	594.	2.	—— Fascia	Nodosaria Raphanus, var. Fascia, *Linn.*	
64.		3.	—— Raphanistrum ..	Nodosaria Raphanus, var. Raphanistrum, *Linn.*	
65.		4.	—— obliqua	Nodosaria Raphanus, var. obliqua, *Linn.*	
37.		5.	—— acicula..........	Nodosaria Raphanus, *Linn.*, var. acicula, *Lam.*	
40.	595.	6.	—— Legumen	Vaginulina Legumen, *Linn.* [*Type*, Nodosaria Raphanus, *Linn.*]	
41.	596.	1.	Nodosaria Radicula....	Nodosaria Raphanus, var. Radicula, *Linn.*	
38.		2.	—— dentalina........	Nodosaria Raphanus, *Linn.*, var. dentalina, [*Lam.*	
66.		3.	—— Siphunculus	Serpula.	
19.	602.	1.	Spirolinites depressa ..	Peneroplis planatus, *F. & M.*	
20.		2.	—— cylindracea	Peneroplis planatus, *F. & M.*, var. cylindracea, [*Lam.*	
21.			—— —— var. *b.*	Clavulina Clavulus, *Lam.* [*Type*, Valvulina triangularis, *d'Orb.*]	
17.	604.	1.	Lituolites nautiloidea ..	Lituola nautiloidea, *Lam.*	
18.	605.	2.	—— difformis	Lituola nautiloidea, var. difformis, *Lam.*	
29.	606.	1.	Renulites opercularis ..	Vertebralina striata, *d'Orb.*, var. opercularia, *Lam.*	
44. 45.	607.	1.	Cristellaria Squammula	Peneroplis planatus, *F. & M.*	
46. 47. 48. 50.		2.	—— papillosa	Cristellaria Cassis, varr. $a, \beta, \gamma, \epsilon$, *F. & M.*	*Type*, Cristellaria Calcar, *Linn.*
49.	608.	3.	—— lævis	Cristellaria Cassis, var. δ, and C. Galea, *F. & M.*	
52.		4.	—— auricularis	Cristellaria acutauricularis, *F. & M.*	
63.		5.	—— Faba	Polystomella crispa, *Linn.*, var. Faba, *F. & M.*	
64.		6.	—— Scapha	Polystomella crispa, *Linn.*, var. Scapha, *F. & M.*	
65.		7.	—— Crepidula	Cristellaria Calcar, *Linn.*, var. Crepidula, *F. & M.*	
66.		8.	—— Auricula	Rotalia repanda, var. Auricula, *F. & M.*	
67.		9.	—— tuberosa	Planorbulina farcta, var. tuberosa, *F. & M.*	
53.	609.	1.	Orbiculina numismalis	Orbiculina adunca, var. Orbiculus, *F. & M.*	
55.		2.	—— angulata	Orbiculina adunca, var. angulata, *F. & M.*	
54.		3.	—— uncinata	Orbiculina adunca, *F. & M.*	
22.	612.	1.	Miliolites ringens	Biloculina ringens, *Lam.*	*Type*, Miliola Seminulum, *Linn.*
23.		2.	—— cor-anguinum ..	Triloculina Cor-anguinum, *Lam.*	
24.		3.	—— trigonula	Triloculina trigonula, *Lam.*	
25.		4.	—— planulata and 2 varieties ..	Spiroloculina planulata, *Lam.*	
56.	615.	1.	Melonites sphærica....	Alveolina Melo, var. *a*, *F. & M.*	
57.		2.	—— sphæroidea......	Alveolina Melo, var. β, *F. & M.*	
7.	617.	1.	Rotalites trochidiformis	Rotalia Turbo, *d'Orb.*, var. trochidiformis, [*Lam.*	
11.	619.	1.	Lenticulina planulata ..	Nummulina planulata, *Lam.*	
12.		2.	—— variolaria	Nummulina planulata, var. Variolaria, *Lam.*	
13.		3.	—— rotulata	Cristellaria Calcar, *Linn.*, var. rotulata, *Lam.*	

	Page.	No.		
42.	621.	1.	Placentula pulvinata ..	Rotalia repanda, *F. & M.*
43.		2.	—— asterisans	Polystomella asterizans, *F. & M.*
6.	623.	1.	Discorbites vesicularis .	Rotalia Turbo, *d'Orb.*, var. vesicularis, *Lam.*
3.	624.	1.	Siderolites calcitrapoïdes	Calcarina Spengleri, *Gmel.*
68.	625.	1.	Polystomella crispa....	Polystomella crispa, *Linn.*
69.		2.	—— costata	Cristellaria Calcar, *Linn.*, var. costata, *F. & M.*
70.		3.	—— planulata	Polystomella crispa, *Linn.*, var. macella, *F. & M.*
71.		4.	—— ambigua	Polystomella crispa, *Lin.*, var. ambigua, *F. & M.*
58.	626.	1.	Vorticialis craticulata ..	Polystomella crispa, *Linn.*, var. craticulata, *F. & M.*
59.		2.	—— strigilata	Polystomella crispa, *Linn.*, var. strigilata, subvar. *a*, *F. & M.*
60.		3.	—— marginata	Polystomella crispa, *Linn.*, var. strigilata, subvar. *β*, *F. & M.*
1.	629.	1.	Nummulites lævigata ..	Nummulina lævigata, *Lam.*
14.		2.	—— globularia	Nummulina lævigata, var. globularia, *Lam.*
15.		3.	—— scabra	Nummulina lævigata, var. scabra, *Lam.*
16.	630.	4.	—— complanata.......	Nummulina complanata, *Lam.*

1. Nummulites lævigata, Syst. An. s. Vert. p. 101; Ann. Mus. v. p. 241, No. 1; viii. pl. 62. fig. 10; Hist. An. s. Vert. vii. p. 629. No. 1. "Fossil: Villers-Coterets." [Defrance adds Soissons and Grignon: Dict. Sc. Nat. xxv. p. 224.]

This appears to have been the first of the coin-shaped Foraminifers, so common in the fossil state as to attract the notice of peasant and of naturalist at an early period, that was subjected to zoological classification under a binomial appellation. A common form in the Eocene Tertiaries of the west of Europe, of large size, and elegantly lenticular in its shape, this was the most prominent of the French Nummulites; and its usual smoothness of surface gave rise to its present trivial name; and its tuberculate variety (*N. scabra*) was subsequently catalogued as a different species. The task of sifting the many names that have been given to the several forms of European Nummulites has been carefully accomplished by d'Archiac and Haime in their fine Monograph on the Fossils of the Nummulitic Strata of India (4to, Paris, 1853). In the list of synonyms of *N. lævigata*, which is very long (*op. cit.* p. 103), they have given as the first regular name "Helicites lenticularis;" but Burtin terms it only *la grande Hélicite ou Lenticulaire*. Bruguière classified it first under the appellation of *Camerina lævigata* (Encycl. Méth. 1789); this was modified to *Nummulites lævigata* by Lamarck (1801), and to *Nummulina lævigata* by D'Orbigny (1826). MM. d'Archiac and Haime have described and illustrated this species in much detail (*op. cit.* p. 104, pl. 4. f. 1–7). Dr. Carpenter also had previously done much to elucidate its structure. (Quart. Journ. Geol. Soc. vol. vi. p. 21, pl. 3 & 4.)

In the 'Ann. Nat. Hist.' 3rd ser. vol. v. p. 109, &c., we have made some remarks on *Nummulinæ* in general (pointing out

especially the erroneous notions published respecting the hyaline columns, or septal pillars), and on *Nummulina lævigata* in particular. This is the type of d'Archiac and Haime's group "subreticulatæ," which we include in the "reticulate" group. It abounded in the European area of the Nummulitic Sea, but appears to be extinct now.

2. Orbitolites complanata. Syst. Anim. s. Vert. p. 376; *Orbulites complanata*, Hist. An. s. Vert. ii. p. 196. We must refer the student to Dr. Carpenter's Monograph (Philos. Trans. 1856, vol. cxlvi. p. 181, &c. pl. 4–9) for the history and detailed description of *Orbitolites*,—the subject being there treated most perfectly. *O. complanata* is common in the warmer seas. Of small size in the Mediterranean, it is larger in the Red Sea, and much larger in the Tropics and South Sea. In the fossil state, it is large in some of the Eocene deposits, and is very common in the Tertiaries of Grignon and Hauteville. It has been found also in the Bracklesham beds (by the Rev. O. Fisher, F.G.S.).

For the synonymy of *O. complanata*, see Dr. Carpenter's memoir above referred to, and especially Morris's 'Catalogue of British Fossils,' 1854, p. 39; also Bronn's 'Lethæa Geognost.' third edit. vol. iii. p. 254.

Lamarck's *Orbitolites concava*, Syst. An. s. Vert. p. 376, is evidently a Lunulite; his *Orbulites concava*, in the Hist. An. s. Vert. ii. p. 197, belongs to the *Orbitolina* of D'Orbigny.

3. Siderolites calcitrapoïdes. Syst. Anim. s. Vert. p. 376; Tabl. Enc. Méth. pl. 470. figs. 4 *a–k*. "Fossil; Chalk, Maestricht: Faujas."

This is the same as the "Nautilus Spengleri" of Gmelin, well figured by Spengler, by Faujas, and by Fichtel and Moll. Lamarck grouped it with the Corals; but D'Orbigny, in his 'Tabl. Ceph.,' judiciously placed it in his genus *Calcarina* (Ann. Sc. Nat. vii. p. 276). *Calcarina Spengleri* is noticed in some detail by us in 'Annals Nat. Hist.' 3 ser. vol. iii. p. 480.

4. Rotalites tuberculosus. Syst. Anim. s. Vert. p. 401. "Fossil; Grignon."

This is possibly the *Rotalia* afterwards termed *R. trochidiformis* by Lamarck; but it is very ill-defined here, and the name is not repeated in subsequent notices of the Foraminifers of Grignon by either Lamarck or others.

5. Oveolites Margaritula. Syst. Anim. s. Vert. p. 402; *Ovulites Margaritula*, Tabl. Enc. Méth. pl. 479. fig. 7; Hist. Anim. s. Vert. ii. p. 194. "Fossil; Grignon."

This is a common Foraminifer of the "Calcaire grossier." Shaped like an egg, and about the size of a mustard-seed, the *Ovulites Margaritula*, when well-grown, is one of the most elegant of the fossil forms. The large terminal apertures, more-

over, in this oval shell curiously impress upon the mind its resemblance to a "blown" bird's egg. The minutely sculptured surface also of many eggs is imitated in the Ovulite by minute superficial depressions, leading to tubular perforations; the shell-wall not being imperforate as in the egg.

Though usually met with as tiny opake white grains, not unlike seed-pearls, yet occasionally specimens that have escaped molecular change present a clear, smooth, glassy appearance, such as belongs to the hyaline group of Foraminifera.

This is the largest of the monothalamous Foraminifera, its one cell averaging the bulk of the entire polythalamous shell of *Miliolæ*, *Rotaliæ*, and many others. The *Orbulina universa*, which is another single-celled form, never has its individuals larger than third-rate specimens of *Ovulites*.

Many small varieties of *O. Margaritula* retain their beautiful ovoid shape; but one of the first steps towards degradation is marked by elongation and occasional constriction, giving to the shell a sausage-like appearance. At another step, we have a long straight tube, open at each end (*O. elongata*, Lamarck); this may be as long as, or longer than, the large oval shells; and it may be clavate at one or both extremities, like a drum-stick or a "life-preserver."

The pores in the shell are comparatively large and sparse; in this it resembles *Globigerina*; whilst in *Orbulina universa* we see, intermixed with these larger pores, a great number of minute tubules. As in large *Globigerinæ* from deep water, and in some varieties of *Bulimina* known as *Bolivinæ*, the surface of the shell, in some of the elongate varieties of *O. Margaritula*, has a delicate honeycomb-like sculpturing, a pore or tubule lying in the hollow centre of each polygonal mesh.

This monothalamous species, though in some respects comparable to the distomous varieties of *Lagena* (a form related to *Polymorphina* and *Nodosaria*), yet has evidently its affinities with the Rotalian group through *Globigerina*. The enormously elongated cells are not inimical to this view; for some *Rotaliæ* occasionally have wildly-growing, attenuated, and prolonged chambers.

The *Ovulites* is of considerable interest in a geological point of view. It appears to have been short-lived as a species. Full-developed in the deposits of Hauteville and Grignon, it breaks in at once in the Eocene period. It lingers as an attenuated form in the Miocene beds of San Domingo.

We may remark that other *Monothalamia*, such as *Lagena* and *Orbulina*, seem to us to be also of comparatively recent origin; the latter comes to us first in the Miocene, and the former in the Upper Chalk of Maestricht (a deposit which con-

tains many Foraminifers that abounded afterwards in the Tertiary seas). Whilst both of these Monothalams are extremely abundant in the existing seas, in almost every latitude and at every depth, a recent Ovulite has not yet been met with. The very restricted distribution of this species in geological time is remarkable; scarcely another Foraminifer presents us with a similarly brief history,—an undescribed form allied to *Dactylopora* affording almost the only parallel (namely, *Acicularia Pavantina*, d'Arch.).

The cylindrical variety of *O. Margaritula* is roughly figured in the 'Tabl. Encycl. Méth.' pl. 479. fig. 8; and the drumstick variety is better figured by Blainville in the 'Dict. Sc. Nat.' Zooph. pl. 48. fig. 3. The large oval Ovulite also is better figured by Blainville (*loc. cit.* fig. 2) than by Lamarck. Michelin (Icon. Zooph. pl. 46. f. 243) figures a double or twin Ovulite. For references to other figures and notices, see Bronn's 'Leth. Geogn.' 3rd edit. iii. p. 258.

6. "Discorbis" was instituted by Lamarck (Ann. Mus. vol. v. p. 182) as a generic name for a group of Rotalian Foraminifera. As he had only met with it in the fossil state, he used the term "Discorbites" in describing the only fossil form of *Discorbis* that he knew, according to his customary plan of modifying the generic name of fossil forms. *Discorbis* and *Discorbites* are not required as generic terms.

Discorbites vesicularis. Ann. Mus. v. p. 183; viii. pl. 62. f. 7: Tabl. Enc. Méth. pl. 466. f. 7 *a, b, c*: Hist. Anim. s. Vert. vii. p. 623. "Fossil; Grignon." [Defrance, Dict. Sc. Nat. xiii. p. 347, gives us other localities, near Versailles, near Mantes, and near Hauteville: he also adds the description of another species from Piedmont, *D. pedemontanus*, Def., and mentions the occurrence of what he believes to be three recent species of *Discorbis*,—one from New Holland, one from the Red Sea, and one from Cherbourg.]

We have in Lamarck's figures some indifferent sketches of a *Rotalia* (both dextral and sinistral), which seems to us to be one which we most commonly meet with in the Calcaire grossier,—a loose-celled and somewhat outspread variety of the more compact *Rotalia Turbo*, d'Orb. (Ann. Sc. Nat. vii. p. 274. No. 39; Modèles, No. 73), which we select as the typical form from amongst a very large group of varieties. The name *Discorbites vesicularis* is given by Defrance to the specimens figured in the 'Dict. Sc. Nat.' Zool. pl. 14. fig. 2 *a, b, c*, which are admirable drawings of the variety under notice when in a rather flatter and more asterigerine* state than those figured by Lamarck.

* Bearing intercalated imperfect chambers arranged starwise on the umbilical face.

D'Orbigny unnecessarily gives to Defrance's figures the name *R. Gervillii* (Ann. Sc. Nat. vii. p. 274, No. 36; Modèles, No. 72. This model is admirable, like most of the others, for its characterization).

Lamarck is not correct in referring this form to Plancus, Conch. Min. Notis, pl. 1. f. 1 (which is *R. Beccarii*).

7. Rotalia. Ann. Mus. v. p. 183. Rotalites trochidiformis. Ann. Mus. v. p. 184, No. 1; viii. pl. 62. f. 8 *a, b*; Tabl. Enc. Méth. pl. 466. f. 8 *a, b*; Hist. An. s. Vert. vii. p. 617. "Fossil; Grignon." [Defrance adds, as localities, Fontenai-Saints-Pères and Hauteville, Dict. Sc. Nat. xlvi. p. 303.]

This is one of the largest *Rotaliæ*, and is the most developed form of the group which is typified by *R. Turbo*, d'Orb. A very much better figure is given in the 'Dict. Sc. Nat.' Zool. pl. 14, f. 3 *a, b, c*. This well-grown shell shows faintly the septal markings on its strong, low, conical spire; on the other or umbilical face, which is flatter, the chambers are covered with granules and separated by deep chinks, margined by larger tubercles, such as fill up and overgrow the umbilicus, sometimes leaving evidence of irregular, astral, intercalated lobes or chambers, sometimes masking the whole of the surface. This is the *R. obscura*, Sowerby (Dixon's Foss. Sussex, p. 162, pl. 9. f. 6), and *R. Neuboldii*, d'Arch. & Haime, Foss. Num. de l'Inde, p. 347, pl. 36. f. 17 *a, b, c*.

We have not yet found this gigantic variety of *R. Turbo* recent, although *R. Turbo* and very large specimens of the variety *vesicularis* are extremely abundant on the coast near Melbourne, Australia.

This extreme form of *R. Turbo* is paralleled in development by a large and strongly tuberculate variety of *R. Beccarii* (var. *Schroeteriana*, nob.); by certain thick and granulate subvarieties of *Planorbulina vulgaris* (var. *larvata*, nob.), in which the original features are masked; and by *Polystomella craticulata*,—the extreme development of *P. crispa* and the giant of the *Polystomellæ*.

8. Rotalites lenticularis (and a sinistral variety). Ann. Mus. v. p. 184, No. 2. "Fossil; Grignon."

Probably a flattish and rather delicate *R. Turbo*, with slightly developed astral flaps. Such a form we find abundantly, fossil at Grignon, and recent on the Australian shores.

9. Rotalites depressa. Ann. Mus. v. p. 185, No. 3. "Fossil; Grignon."

This answers well to some of the large Truncatuline varieties of *Planorbulina farcta*: we find many of these in the Calcaire grossier and other French Tertiaries.

10. Rotalites Discorbula. Ann. Mus. v. p. 185, No. 4; viii.

pl. 62. f. 9. *Discorbula Ariminensis,* Tabl. Enc. Méth. pl. 466. f. 6 *a*, *b*. "Fossil; Grignon."

This is *Rotalia Beccarii,* Linn., of common occurrence.

11. Lenticulina. Ann. Mus. v. p. 186. This comprises some small *Nummulinæ* and a *Cristellaria.* Lamarck states that he had recent *Lenticulinæ* from the Sea near Teneriffe, taken at 125 feet depth. Defrance, however, doubts this, and thinks that the specimens were *Cristellariæ,* and probably fossilized (Dict. Sc. Nat. xxv. p. 452). We have found two "Lenticuline" forms very common in the sea-sands (at 50 fathoms) off Orotava, Teneriffe, namely, *Amphistegina vulgaris* and *Cristellaria Calcar,* var. *rotulata.* Lamarck's genus "Lenticulina" (like his other genera of "microscopic Cephalopodous shells") evidently rests on very indefinite grounds.

Lenticulites planulata. Ann. Mus. v. p. 187, No. 1; Hist. An. s. Vert, vii. p. 619, No. 1. "Fossil; Senlis, Rétheuil near Villers-Coterets, and Soissons." [Defrance adds Betz and Gilocourt.]

This was recognized as a *Nummulina* by D'Orbigny (Ann. Sc. Nat. vii. p. 296, No. 4); and it is the type of the "radiate" group of Nummulites. (See Annals Nat. Hist. ser. 3. vol. v. p. 109.) *N. planulata* is fully described and illustrated by d'Archiac and Haime (Foss. Num. de l'Inde, p. 142, pl. 9. f. 5–10), by whom also the localities of its occurrence are carefully enumerated.

12. Lenticulites variolaria. Ann. Mus. v. p. 187, No. 2; Hist. An. s. Vert. vii. p. 619, No. 2. "Fossil; Grignon, Betz, and Chaumont." [Defrance adds Parnes and Acy.]

Sowerby recognized this as a Nummulite (under the term *Nummularia variolaria,* Min. Conch. pl. 538. f. 3). D'Archiac and Haime give the history and description of *Nummulina variolaria,* op. cit. p. 146, pl. 9. f. 13 *a–g*. We agree with Prof. Williamson in regarding *N. variolaria* as a small biconvex variety of *N. planulata* (Williamson, Monogr. p. 39).

13. Lenticulites rotulata. Ann. Mus. v. p. 180, No. 3; viii. pl. 62. fig. 11; Tabl. Enc. Méth. pl. 466. fig. 5; Hist. An. s. Vert. vii. p. 620, No. 3. "Fossil; Chalk, Meudon."

D'Orbigny (Mém. Soc. Géol. France, 1840, vol. iv. p. 26) was the first to separate this from the other *Lenticulinæ* or *Lenticulites* (which he arranged in their place as *Nummulinæ*), and to group it in the genus *Cristellaria,* defined by him far more correctly than by Lamarck, who had selected a *mélange* of broadly Nautiloid unrelated forms from Fichtel and Moll's plates, and given them this generic name (Anim. s. Vert. vii. p. 607).

Cristellaria rotulata is a common keelless variety of *C. Calcar*

(see Annals Nat. Hist. 2 ser. vol. xix. p. 273), and is exceedingly abundant both in the fossil and the recent state.

14. Nummulites globularia. Ann. Mus. v. p. 241, No. 2; Hist. An. s. Vert. vii. p. 629, No. 2.

"Fossil; Rétheuil." [Defrance adds Morlaie near Chantilly, and Transylvania, Dict. Sc. Nat. xxxv. p. 224.]

Defrance was correct in regarding this as merely a variety of *N. lævigata*; it is the Cherry-stone variety.

15. Nummulites scabra. Ann. Mus. v. p. 241, No. 3; Hist. An. s. Vert. vii. p. 629, No. 3. "Fossil; Soissons." [Defrance adds Parnes and Saint-Félix.]

This is a nearly constant companion of *Nummulina lævigata*; and as every intermediate stage of granulation (from the mere appearance of hyaline spots on the septa and at the points where the inosculating canals of the alar flaps intersect one another, to upraised semicrystalline granules) is readily found among fifty or more specimens from the Nummulitic sandy beds at Bracklesham, Brussels, and elsewhere, we cannot but regard this as a mere variety of *N. lævigata*. Similar conditions obtain with *Nummulina planulata*, especially among its recent Operculine varieties. Nor are the members of the "sinuate" group without their similarly granulate or scabrous conditions of growth.

N. scabra has the same plan of growth that *N. lævigata* has, and closely follows its type in its variations of external form. This has also been noticed by d'Archiac and Haime, whom we cannot follow in giving a specific standing to *N. scabra*. Their remarks on, and history of this form (Foss. Num. de l'Inde, p. 107, pl. 4. figs. 9–12) may, however, be studied with advantage.

16. Nummulites complanata. Ann. Mus. v. p. 242, No. 4; Hist. An. s. Vert. vii. p. 630, No. 4. "Fossil; Soissons?"

The locality given by Lamarck with doubt is incorrect. The Nummulite here referred to is recognized as one belonging to Eastern Europe. The detailed account of this Nummulite and its synonymy given by d'Archiac and Haime (*op. cit.* p. 87, pl. 1. figs. 1–3) should be consulted.

With us, *Nummulina complanata* is the specific centre of a suite of forms (peculiar to the East) having narrow, shallow, sinuate alar lobes, and belonging to d'Archiac and Haime's group "læves aut sublæves," but which we term "sinuatæ."

17. Lituola. Ann. Mus. v. p. 242. Lituolites nautiloidea, Ann. Mus. v. p. 243, No. 1; viii. pl. 62. fig. 12; *Lituola nautiloides*, Tabl. Enc. Méth. pl. 465. fig. 6; *Lituolites nautiloidea*, Hist. An. s. Vert. vii. p. 604, No. 1. "Fossil; Chalk, Meudon."

This is a type of an important group of forms among the

white*, opake, non-tubuliferous, calcareous-shelled *Rhizopoda*. As in some groups of the hyaline *Foraminifera*, the shell is here principally composed of siliceous sand, the shell-matter being only in sufficient quantity to serve as a cement for the sand-grains.

Lituola, in its simplest form, is a mere string of suboval, successively enlarging chambers, more or less irregular in outline (*Reophax Scorpiurus*, Montfort). A similar, but attached, series of plano-convex chambers (the lower face being often imperfect) has been described as "Œufs de Mollusques" by Cornuel (Mém. Soc. Géol. France, 2 sér. iii. pl. 4. f. 36). These latter often have a more or less coiled set of commencing chambers; and then we have the *Placopsilina Cenomana*, d'Orb. (Reuss, Abhandl. Wien, vii. p. 71, pl. 28. f. 4, 5). These fixed Placopsiline forms are often wild in their growth, spreading and bifurcating with great irregularity and to considerable extent (as much as an inch in length sometimes); simple Nautiloid forms also occur fixed (*Lituola nautiloides*, Schroeter, sp., Ann. Nat. Hist. 3 ser. iii. p. 482). In a free state we find numerous Nautiloid symmetrical *Lituolæ*, of small growth, such as we have already characterized in Ann. Nat. Hist. 2 ser. xix. p. 301, under the name of *Placopsilina Canariensis*, d'Orb. sp., from Norway. A smaller and flatter form is figured by Prof. Williamson (Monogr. p. 34, pl. 3. f. 72, 73) under the name of *Nonionina Jeffreysii*; this is common on the British coasts, and indeed is of wide distribution.

This Nautiloid form of *Lituola* is succeeded by crozier-shaped forms, such as the so-called *Spirolina agglutinans*, d'Orb. For. Foss. Vien. pl. 7. f. 10–12, and the "Spirolinites" so common in the Chalk. Many of the larger of these latter have their chambers subdivided.

The septal opening varies in the different above-mentioned forms, from the simple roundish passage, or Nonionine slit, of the arrested varieties, to the oblong, lobed, jagged, or compound apertures seen in the more typical free shells.

Lituola nautiloidea, Lamarck, is a well-developed crozier-shaped shell: it has its chambers subdivided throughout; and its round or oval, and slightly convex, septal plane is pierced with many passages. It is very common and large in the Chalk.

* In the living state, *Orbitolites*, *Peneroplis*, and *Alveolina* (members of the "opake" group of *Foraminifera*) have their shell-substance pink or reddish, the milky whiteness of the dead shells being the result of bleaching. This appears also to be the case with regard to *Lituola*; as many recent specimens have a reddish or ferruginous appearance, although their constituent sand-grains are in themselves colourless. Prof. Williamson has noticed a similar condition in other Foraminifers (Monogr. p. 65).

A rectilinear or Nodosaria-like *Lituola*, with an extremely labyrinthic subdivision of its chambers, is common in the Tertiaries of San Domingo, Malaga, and Tuscany (figured by Soldani), and occurs recent in the mud of the Abrolhos Bank, east of Rio Janeiro.

18. Lituolites difformis. Ann. Mus. v. p. 243, No. 2; viii. pl. 62. f. 13 *a, b*; Hist. An. s. Vert. vii. p. 605. No. 2; *Lituola difformis*, Tabl. Enc. Méth. pl. 466. f. 1 *a, b*. "Fossil; Chalk, Meudon."

A small irregularly grown *Lituola nautiloidea*.

[To be continued.]

XXXIII.—*On the Marginal Nerves of the Leaves of Mosses.* By George Gulliver, F.R.S., Fellow of the Royal College of Surgeons of England, and Honorary Fellow of the Royal College of Surgeons in Ireland.

The term 'nerve' is here used for the leaf-rib, in the same sense as it has always been employed (though so inconveniently) by botanists, and without the least reference either to the function or to the structure of the very different and more important cords with the same name in the animal kingdom.

While so much attention has been paid to the mid-nerve of moss-leaves, it seems singular that even the existence of the marginal nerves, identical in structure with the mid-nerve, has not been recognized by systematic writers in Britain. At least, I believe there is no notice of the kind in the classical works of Smith and Hooker, nor in the recent 'Bryologia Britannica' of Mr. Wilson; and as in this last excellent book the system of Bruch and Schimper is adopted, I presume the same remark will apply to their celebrated 'Bryologia Europæa,' which I have not yet seen. Moreover, in a cursory reference to M. Schimper's 'Recherches sur les Mousses' (4to, Strasburg, 1850), I could find no such mention of marginal leaf-nerves. Indeed, descriptive bryologists say "nerve excurrent," "nerve vanishing," and so forth, for the mid-nerve, as if there were no other nerve in a moss-leaf, as, no doubt, is most often, but by no means always, the case, independently of the well-known double nerve in certain genera.

This is the more remarkable, as the marginal nerves can be so easily demonstrated by very slight dissection under the microscope, while their course and structure will probably be found to afford good specific characters. Schleiden ('Principles of Scientific Botany,' p. 188, transl. by Dr. Lankester, 8vo. Lond. 1849) has depicted them in *Mnium punctatum*, and justly observes that the leaves of Mosses and their nerves merit a more thorough investigation than they have hitherto received.

I have examined the marginal nerves in the leaves of a great number of Mosses, and in some instances have seen them extending from the very cells of the axis or stem to the point, or beyond the point, of the leaf-blade; and these nerves may generally be found when the border of the leaf is described as "cartilaginous" or "thickened," though their structure, being commonly a soft and juicy prosenchyma, has no relation whatever to the structure of cartilage, nor to the bryological definition of it—"a hard close texture, not tender and succulent."

The following extracts from my note-book will render it easy for the bryologist to examine these nerves, without the aid of a drawing, particularly as the kindness of Mr. Mitten has made me sure of the identity of the species.

Atrichum undulatum. Dec. 1859. Very distinct marginal nerves from the stem to the point of the leaf, and $\frac{1}{1280}$ of an inch in diameter, the mid-nerve being fully thrice as large. The measurements in this and the following instances are made near the middle of the nerves.

Fissidens bryoides. Dec. 3, 1859. Marginal nerves very plain, $\frac{1}{2286}$ of an inch in diameter, while the mid-nerve is $\frac{1}{710}$.

Fissidens tamarindifolius. Dec. 23, 1859. Marginal nerves as distinct as in *F. bryoides,* and $\frac{1}{2460}$ of an inch in diameter, the mid-nerve being $\frac{1}{696}$.

Mnium hornum. Jan. 1860. Marginal nerve $\frac{1}{800}$ of an inch in diameter, extending most plainly from the base to the apex of the leaf, and composed of about three rows of prosenchymatous cells remarkably distinct from the contiguous squarish or polyhedral parenchymatous cells of the leaf-blade.

Bryum capillare. Jan. 1860. Marginal nerves $\frac{1}{1230}$ of an inch in diameter, scarcely distinguishable from the neighbouring cells of the leaf-blade, though portions of the nerve may be sometimes torn off, and it can be traced into the apiculus of the leaf. This leaf is a fair specimen of a connecting link between the presence and absence of a plain marginal nerve.

XXXIV.—*On some New Genera and Species of Mollusca from Japan.* By Arthur Adams, F.L.S., &c.

To the Editors of the Annals of Natural History.

Tsu-Sima, Straits of Korea,
5th Dec., 1859.

Gentlemen,

In the course of our circumnavigation of the Sea of Japan, in H.M.S. 'Actæon,' the dredge was sometimes put in requisition, and, in addition to a better acquaintance with the geographical distribution of marine life which was thereby afforded,

new forms were occasionally met with. I enclose, with a request that you will be so good as to insert them in your Journal, descriptions of those among the *Mollusca* which were the most interesting, and am, Gentlemen,

Your obedient servant,

Arthur Adams.

Genus Constantia, A. Adams.

Testa acuminato-ovalis, rimata, spira elata, attenuata; anfractibus rotundatis, ultimo ventricoso, plicis tenuibus longitudinalibus et liris elevatis transversis decussatis. Apertura ovalis, longior quam lata; peritremate libero, continuo, margine integro, acuto.

This genus, I believe, belongs to the natural family *Scalidæ*, although the whorls are not disunited or ribbed; the aperture, moreover, is oblong, and the texture of the shell very thin.

Constantia elegans, A. Adams.

C. testa tenui, rimata, acuminato-ovali, pallide fusca; anfractibus sex, tribus supremis lævibus simplicibus, anfractibus alteris plicis tenuibus longitudinalibus et lirulis transversis reticulatis; apertura oblonga, peritremate continuo, margine libero, acuto.

Hab. Straits of Korea, near Mino-Sima; dredged from 63 fathoms.

Genus Iole, A. Adams.

Testa turrito-subulata, umbilicata; anfractibus convexiusculis, transversim sulcatis, sulcis subdistantibus, interstitiis longitudinaliter concinne striatis. Apertura oblonga, postice acuminata, antice integra, rotundata; labio libero, simplici, acuto.

This genus is founded upon a deep-water shell, of which, unfortunately, I possess but a single specimen. It most nearly resembles a perforate, elongated, sulcate *Odostomia*, without any tooth or fold on the inner lip.

I am unable to refer it to any genus, and consequently give it generic rank myself. The practice of throwing a doubtful form into any genus seems to me to retard the progress of science,—shirking a difficulty, and confusing the mind of the student. The number of genera is of no more moment to the naturalist than the number of species, provided they each represent a particular type of form. The natural position of *Iole* is, perhaps, between *Monoptygma* and *Menestho*.

Iole scitula, A. Adams.

I. testa subulato-turrita, profunde umbilicata, alba, solidiuscula; anfractibus sex, convexiusculis, transversim sulcatis, sulcis subdistantibus, interstitiis longitudinaliter concinne striatis; apertura oblonga, antice rotundata, postice acuminata; labio simplici; labro margine acuto.

Hab. Straits of Korea; dredged from 63 fathoms.

Genus Mucronalia, A. Adams.

Testa pupiformis, ovato-oblonga, apice subito mucronata; anfractibus mucronis tribus perparvis; anfractibus normalibus quinque planatis, ultimo ad basin rotundato. Apertura oblongo-ovalis, antice dilatata et producta; labio simplici; labro arcuato.

This curious genus seems to be compounded of *Leiostraca* and *Stylifer*, but is not variced or compressed like the former, and is not unicolorous and parasitic like the latter. The texture is unlike that of *Stylifer*, and resembles that of *Eulima*; and the structure of the mucro does not resemble that of the pointed apex in *Stylifer*.

Mucronalia bicincta, A. Adams.

M. testa albida, subpellucida, nitidissima, fascia rufa ornata; anfractu ultimo bicincto.

Hab. Straits of Korea, off Mino-Sima; dredged from 63 fathoms.

Genus Mörchia, A. Adams.

Testa oblique ovata, late umbilicata, depressa, superne convexa, inferne plana; anfractibus subito crescentibus, ultimo dilatato ascendente alios involvente usque ad apicem. Apertura oblonga, obliqua, subhorizontalis, infra dilatata, supra angustata; peritremate continuo, incrassato.

M. obvoluta, A. Adams.

M. parva, opaca, alba, ad peripheriam angulata, striis incrementi confertis ornata; umbilico patulo, ad suturas crenulato.

Hab. Tsu-Sima, Straits of Korea.

This curious little genus most nearly resembles *Teinostoma*; but the base is not covered with a callus, and the mouth is not produced. The last whorl embraces the others, as it does in *Neritula* or *Cyclops*. Both *Mörchia* and *Teinostoma*, however, together with *Vitrinella*, are not nacreous, and would seem to associate themselves rather with *Adeorbis* and *Cyclostrema* than with *Ethalia* among the *Umboniinæ*, as Mr. P. P. Carpenter believes. The only specimen obtained was dredged from 26 fathoms, about a quarter of a mile from the shore, in Washington Sound, off Tsu-Sima, a very lovely island in the Straits of Korea. The bottom was coarse sand and broken shells.

The genus is named after M. O. A. L. Mörch, author of 'Prodromus Faunæ Molluscorum Grönlandiæ,' and a man "in advance of his age."

Genus Zeidora, A. Adams.

Testa oblonga, dorso convexa, apice postice deflexo, superficie cancellata sulco mediano antice in fissuram desinente instructa.

Apertura ampla, septo interno plano semilunari ad partem posticam instructa; margine crenulato, antice valde fissurato.

This genus seems to combine the characters of *Crypta* and *Emarginula*, and almost deserves to be considered the type of a new family. The internal septum distinguishes it from all the other *Fissurellidæ*.

Zeidora calceolina, A. Adams.

Z. testa oblonga, lineis elevatis concentricis et radiantibus eleganter cancellata; sulco mediano lateribus elevatis; apice postice deflexo; septo margine acuto, integro.

Hab. Straits of Korea, 16 miles from Mino-Sima; 63 fathoms.

Genus Cranopsis, A. Adams.

Testa ovata, pileiformis, superficie cælata, apice integro, subspirali, postice recurvo. Perforatio elongata, intus concamerata, inter apicem et marginem anticum posita. Apertura ovalis, expansa, margine crenulato.

This genus has the internal vaulted chamber over the foramen, as in *Cemoria*, and the sculptured surface and median position of the perforation, as in *Rimula*. The specimens serving for the description were all adult shells, and are not the young of *Glyphis*.

Cranopsis pelex, A. Adams.

C. testa pileiformi, liris radiantibus crenulatis interstitiis cancellatis ornata; fissura intus concamerata, marginibus callosis, extus labiis elevatis longitudinalibus marginatis; foramine lineis incrementi transversis apicem versus currentibus; margine crenulato.

Hab. Off Mino-Sima, Straits of Korea; dredged from 63 fathoms.

Genus Kleinella, A. Adams.

Testa ovata, tenuis, umbilicata, superficie cancellata; spira producta, apice obtuso. Apertura elongata, antice producta et integra; labio tenui, simplici; labro postice angulato, in medio recto, margine acuto.

This genus most nearly resembles *Actæon*, but is without any fold on the columella; the umbilicus, moreover, is wide and deep, and the surface of the shell is cancellated. The outer lip forms an angle posteriorly with the last whorl, and is straight in the middle.

Kleinella cancellaris, A. Adams.

K. testa oblonga, late et profunde umbilicata; spira elatiuscula, apice obtuso; pallide fusca; anfractibus $3\frac{1}{2}$ convexiusculis (ultimo ven-

tricoso), regulariter cancellatis; apertura ovali; labio tenui, simplici; labro in medio recto, postice angulato. Long. $\frac{1}{8}$ poll.

Hab. Straits of Korea; dredged from 63 fathoms.

Genus Sarepta, A. Adams.

Testa transversim ovalis, æquivalvis, æquilateralis, intus non-margaritacea. Cardo dentibus pluribus acutis in serie rectiuscula dispositis; ligamento interno, in fossula centrali posito. Impressiones musculares distantes; impressio pallii integra.

This genus agrees with *Nucula* in the simple pallial line and internal ligament, and with *Malletia* in not being nacreous or pearly within, and in general form and character. It belongs to a distinct subfamily between *Nuculinæ* and *Malletiinæ*.

Sarepta speciosa, A. Adams.

S. testa ovata, alba, epidermide tenui obtecta, concentrice substriata, compressiuscula, postice vix hiante, intus non-margaritacea.

Hab. 16 miles from Mino-Sima, Straits of Korea; from 63 fathoms.

Genus Huxleyia, A. Adams.

Testa æquivalvis, transversim oblonga, obliqua, valde inæquilateralis, clausa, intus non-margaritacea, epidermide tenui obtecta, superficie valvarum concentrice sulcata. Cardo dentibus sex acutis divergentibus (cristam formantibus), postice inclinatis et in lamina curvata desinentibus; ligamento interno in fossula sub umbone. Impressiones musculares distantes; linea palliali simplici.

Perhaps the nearest approach to this genus is *Limopsis*, and in some respects it also resembles *Sarepta*, but it differs widely from both. It is named after Prof. Huxley, who has devoted so much attention to the structure of the lower forms of Mollusca. It would seem to belong rather to the family *Arcidæ* than to *Nuculidæ*, the interior not being nacreous.

Huxleyia sulcata, A. Adams.

H. testa antice breviore, postice longiore, valvarum superficie concentrice sulcata, sulcis profundis distantibus; intus non-margaritacea; umbone parvo, simplici, margine ventrali integro.

Hab. 16 miles from Mino-Sima, Straits of Korea; dredged from 63 fathoms.

P.S. I may take this occasion to observe, for the information of conchologists, that Dr. Chenu, in his last beautiful work (Manuel de Conchyliologie, p. 162, fig. 775), has figured by mistake the *Nassa* elegans of Kiener as the type of *Zaphon*, H. and A. Adams, instead of *Buccinum* elegans, Reeve, which is a very different shell, and a very singular typical form.

[To be continued.]

XXXV.—*Characters of some apparently undescribed Ceylon Insects.* By F. Walker.

[Continued from vol. iv. p. 376.]

Fam. Eumenidæ.

Odynerus tinctipennis (Sect. *Ancistrocerus*, Wesm.). *Fœm.* Niger, rude punctatus, capite lituris sex flavis, prothorace linea transversa interrupta testacea, mesothorace guttis quatuor lateralibus flavis, metathorace linea transversa flava, abdomine fasciis duabus flavis, femoribus anterioribus flavo strigatis, alis nigricantibus.

Female. Black, roughly punctured. Head with a short yellow line behind each eye, and with a shorter yellow line in the notch of each eye; clypeus finely punctured, with a yellow spot on each side. Prothorax with a transverse testaceous line, which is attenuated and interrupted in the middle. Two yellow dots at the base of each fore-wing, the hind one divided. Metathorax with a short transverse yellow line. Abdomen finely punctured hindward; first and second segments with yellow hind borders. Anterior femora with a yellow apical stripe on the outer side. Wings blackish; veins and stigma black. Length of the body 5 lines; of the wings 8 lines.

Odynerus intendens (Sect. *Ancistrocerus*, Wesm.) *Fœm.* Niger, rude punctatus, capite punctis quatuor rufis, antennis subtus apiceque rufescentibus, scapo subtus flavo, abdomine fasciis duabus albidis, tibiis tarsisque subtus rufescentibus, tibiis anticis intus flavis, alis cinereis.

Female. Black, roughly punctured. Head with a red point behind each eye, and with another in the notch of each eye; a pale point between the antennæ, which are reddish beneath and at the tips; clypeus thinly punctured, with a curved transverse piceous line at its base. Scape yellow beneath. Abdomen smooth towards the tip; first and second segments with whitish hind borders. Tibiæ and tarsi beneath and knees reddish; fore tibiæ yellow on the inside. Wings cinereous; veins and stigma black; second submarginal areolet divided by an additional veinlet. Length of the body 4 lines; of the wings 6 lines.

Fam. Crabronidæ.

Stigmus congruus. *Fœm.* Niger, elongatus, glaber, nitens, clypeo linea interrupta fulva, ore flavo, antennis piceis, scapo subtus flavescente, metathorace rude punctato, pedibus flavescentibus, femoribus tibiisque posticis nigris, femoribus anterioribus nigro fasciatis, alis vitreis.

Female. Black, elongate, smooth, shining. Head much broader than the thorax, impressed longitudinally, and with a slight keel between the eyes; clypeus with an interrupted tawny line in front; mouth yellow. Antennæ piceous, slender; scapus dull yellowish

beneath. Metathorax roughly punctured, with a longitudinal impressed line. Petiole long, slender. Legs yellowish; hind femora and hind tibiæ black; anterior femora with a black band. Wings quite vitreous; veins and stigma black. Length of the body $3\frac{1}{2}$ lines; of the wings 4 lines.

Fam. Larridæ.

LARRADA EXTENSA. *Mas.* Nigra, argenteo pubescens, capite magno supra plano antice bicarinato, scutello minimo nitente, metathorace maximo sulcato bituberculato, abdomine fusiformi basi apiceque nitente, pedibus robustis, femoribus incrassatis, alis nigricantibus.

Male. Black, hardly shining, with silvery pubescence. Head much broader than the thorax, flat above, vertical and with two slight keels in front. Antennæ filiform, piceous at the very base. Scutellum shining, very small. Metathorax much developed, nearly vertical and with a slight furrow hindward; the ridge with two tubercles. Abdomen fusiform, shining at the base and at the tip, not longer than the thorax. Legs stout; femora incrassated. Wings blackish; veins and stigma black. Length of the body 4 lines; of the wings 5 lines.

Fam. Apidæ.

ANDRENA EXAGENS. *Fœm.* Nigra, scitissime punctata, cinereo pilosa, capite rude punctato, antennis subclavatis apice rufis corporis dimidio non longioribus, abdomine rufo elliptico segmentis tribus posticis nigris, genubus rufis, tarsis testaceis, alis subcinereis.

Female. Black, shining, very finely punctured, with cinereous hairs. Head roughly punctured, very pubescent in front, a little broader than the thorax. Antennæ subclavate, about half the length of the body, red at the tips. Abdomen red, elliptical, a little broader and longer than the thorax; last three segments black. Knees reddish; tarsi testaceous. Wings slightly cinereous; veins and stigma black. Length of the body 3 lines; of the wings 5 lines.

NOMIA VINCTA. *Fœm.* Nigra, opaca, lata, crassa, punctata, cinereo pubescens, ore testaceo basi nigro, antennis subclavatis capite non longioribus, abdomine elliptico nitente scitissime punctato fasciis tribus cinereo tomentosis, tarsis subtus pallidis, alis cinereis.

Female. Black, dull, broad, thick, very closely and minutely punctured, with cinereous pubescence. Mouth testaceous, black at the base. Antennæ subclavate, as long as the head. Abdomen elliptical, shining, very finely punctured, a little longer and broader than the thorax, with three bands of cinereous tomentum. Tarsi pale beneath. Wings cinereous; veins and stigma black; third submarginal areolet much less than twice the length of the second. Length of the body $3\frac{1}{2}$ lines; of the wings 6 lines.

TRIGONA PRÆTERITA. *Fœm.* Nigra, brevis, lata, glabra, nitens, capite opaco subscabro sulcato, antennis testaceis filiformibus

apice acutis, thorace transverse sulcato, scuto utrinque excavato, abdomine basi subtusque testaceo, pedibus crassis, tarsis testaceis, femoribus posticis valde dentatis, alis cinereis.

Female. Black, short, broad, smooth, shining. Head dull, minutely scabrous, with a furrow between the eyes. Antennæ testaceous, filiform, with acute tips. Scutum excavated on each side hindward; a deep transverse impression between it and the scutellum. Abdomen testaceous at the base and beneath. Legs thick; tarsi testaceous; hind tibiæ much dilated. Wings cinereous; veins and stigma black. Length of the body $2\frac{1}{2}$ lines; of the wings 4 lines.

Fam. Dorylidæ.

Enictus porizonoides. *Mas.* Fulvus, cylindricus, nitens, cinereo-pubescens, capite nigro, antennis thorace brevioribus, scapo dilatato, flagello lanceolato, abdomine sessili, pedibus brevissimis, alis cinereis amplis, venis piceis basi fulvis, stigmate nigro.

Male. Tawny, cylindrical, shining, with cinereous pubescence. Head black. Antennæ shorter than the thorax; scape dilated; flagellum lanceolate. Abdomen sessile, nearly twice the length of the thorax. Legs very short. Wings ample, cinereous; veins piceous, tawny towards the base; stigma black. Length of the body $3\frac{1}{2}$ lines; of the wings 7 lines.

Fam. Ichneumonidæ.

Pimpla albopicta. *Fœm.* Nigra, nitens, subtus rufa, capite albo, antennis albo fasciatis, scapo rufo, thorace lituris plurimis albis, abdomine cylindrico lineolis duabus fasciisque albis, oviductu brevi, pedibus rufis, coxis albo strigatis, tarsis posticis nigris, alis cinereis.

Female. Black, shining, red beneath. Head white, with a yellow stripe in front. Eyes with a concave border between the antennæ. Palpi white. Antennæ black, long, slender, with a white band before the middle; scape red. Thorax with several white marks. Abdomen cylindrical, narrower and much longer than the thorax; two little longitudinal white lines at the base; hind borders of the segments with white bands, which are testaceous in the middle. Oviduct less than half the length of the body. Legs red; a white mark on each coxa; hind tarsi black. Wings cinereous; veins and costa black; discal areolet irregularly tetragonal; exterior side less than half the length of the interior side. Length of the body 6 lines; of the wings 10 lines.

This species is erroneously named *Cryptus albopictus* in the list of Ceylon insects lately published in Sir E. Tennent's work on Ceylon.

Cryptus? onustus. *Fœm.* Niger, scite scabrosus, capite lineis duabus albis, antennis albo fasciatis, articulis basalibus longis paucis; scapo crasso, scutello albo, metathorace spinis duabus albis crassis, petiolo rufo, abdomine fusiformi scitissime punctato

albo unifasciato subtus lurido, pedibus rufis longis robustis, alis lurido-cinereis.

Female. Black, slightly shining, finely scabrous. Head with a white line on each side of the vertex. Antennæ long, with a white band at a little beyond the middle, between which and the scape there are four long joints, the first red at the base; scape thick. Scutellum white. Metathorax with two short stout white spines. Abdomen fusiform, very finely punctured, lurid beneath, white at the tip; petiole red, increasing in thickness hindward, with a white hind border; first segment with a white hind border. Legs red, long, stout. Wings lurid-cinereous; veins and stigma black; discal areolet small, tetragonal. Length of the body five lines; of the wings 8 lines.

This species may form a new genus.

HEMITELES? VARIUS. *Fœm.* Niger, capite gutta flava, antennis rufis basi flavis apices versus nigris, abdomine fusiformi macula dorsali flava, pedibus flavis, tibiis posticis piceo-fasciatis, alis albis nigro bifasciatis.

Female. Black, shining. Head with a yellow dot at the base of the antennæ; mouth yellow. Antennæ red, very slightly increasing in thickness from the base to the tips, yellow at the base, black towards the tips, nearly as long as the body. Abdomen fusiform, much longer than the thorax, with a large yellow spot near the base; sheaths of the ovipositor less than half the length of the body. Legs yellow; a black point on each fore trochanter; tips of hind femora and a broad band on the hind tibiæ piceous. Wings white; veins black, yellow at the base. Fore wings with two black bands, the exterior one much broader than the inner one. Length of the body 2 lines; of the wings 4 lines.

PORIZON DOMINANS. *Mas.* Niger, obscurus, confertissime punctatus, antennis basi rufis, metathorace subcarinato, abdomine rufo glabro nitente clavato, lituris lateralibus basique nigris, pedibus rufis, tibiis tarsisque posticis piceis, alis cinereis.

Male. Black, opake, very minutely and thickly punctured. Antennæ little more than half the length of the body, red at the base. Metathorax with a slight middle keel. Abdomen red, clavate, smooth, shining, darker towards the tip, with minute black marks on each side, less than twice the length of the thorax; petiole long, black, slender. Legs red; hind tibiæ and hind tarsi piceous. Wings cinereous; veins and stigma black. Length of the body $3\frac{1}{2}$ lines; of the wings $4\frac{1}{2}$ lines.

Fam. Braconidæ.

MICROGASTER Sect. *Mas.* Corpus robustum, breve, latum. Caput subquadratum, thorace non latius. Antennæ robustæ, corpore paullo longiores, articulis plurimis coarctatis. Abdomen sessile,

lineare, thorace valde angustius paulo brevius. Pedes robusti, breves, femoribus tibiisque posticis dilatatis.

Male. Body robust, broad, short. Head subquadrate, as broad as the thorax. Antennæ stout, a little longer than the body, with less than twenty closely connected joints, which successively decrease in length. Abdomen sessile, linear, much narrower and a little shorter than the thorax. Legs stout, short; hind femora and hind tibiæ dilated. Wings moderately broad; discal areolet complete.

The following species was erroneously separated from *Microgaster*, and mentioned as forming a new genus (*Liganira*) in the list of Ceylon insects referred to above.

MICROGASTER DETRACTUS. *Mas.* Niger, obscurus, confertissime punctatus, antennis piceis basi rufescentibus, abdomine glabro, subtus albido, pedibus anterioribus testaceis, femoribus anterioribus basi piceis, alis cinereis, venis stigmateque nigris.

Male. Black, opake, very thickly and minutely punctured. Antennæ piceous, reddish towards the base. Abdomen smooth, shining, whitish beneath. Legs testaceous; anterior femora piceous towards the base; hind legs black; hind coxæ testaceous. Wings cinereous; veins and stigma black. Length of the body $1\frac{3}{4}$ line; of the wings 4 lines.

MICROGASTER RECUSANS. *Fœm.* Niger, robustus, obscurus, confertissime punctatus, antennis validis corpore vix brevioribus, abdomine glabro compresso subtus basi albido, tibiis tarsisque anterioribus testaceis, femoribus tibiisque posticis subdilatatis, alis nigricantibus.

Female. Allied to *M. tibialis.* Black, robust, opake, very thickly and finely punctured. Antennæ stout, almost as long as the body. Abdomen smooth, shining, much compressed, whitish beneath at the base, not longer than the thorax. Ovipositor shorter than the abdomen. Anterior tibiæ and tarsi and tips of anterior femora testaceous; hind femora and hind tibiæ slightly dilated; hind knees testaceous. Wings blackish; veins and stigma black; a whitish point at the inner end of the stigma. Length of the body $1\frac{1}{2}$ line; of the wings 3 lines.

MICROGASTER SIGNIFICANS. *Mas.* Niger, obscurus, confertissime punctatus, antennis corpore longioribus, abdomine glabro angusto, tibiis tarsisque anterioribus testaceis, femoribus tibiisque posticis subdilatatis, tibiis posticis basi testaceis, alis venis stigmateque albidis, vena costali extus nigra.

Male. Nearly allied to *M. xanthostigma*; antennæ rather longer and stouter. Black, opake, very closely and finely punctured. Antennæ longer than the body. Abdomen smooth, shining, much narrower than the thorax. Anterior tibiæ and anterior tarsi and tips of anterior femora testaceous; hind femora and hind tibiæ slightly dilated; hind tibiæ testaceous towards the base. Wings, veins, and stigma whitish; costal vein exteriorly and veinlet along

the outer side of the stigma black. Length of the body $1\frac{3}{4}$ line, of the wings $3\frac{1}{2}$ lines.

MICROGASTER SUBDUCTUS. *Mas.* Niger, obscurus, confertissime punctatus, antennis gracilibus corpore non longioribus, abdomine glabro angusto, tibiis tarsisque anterioribus testaceis, femoribus tibiisque posticis subdilatatis, tibiis posterioribus basi testaceis, alis venisque albidis, vena costali extus nigra, stigmate pallide lurido.

Male. Allied to *M. xanthostigma.* Black, opake, very closely and finely punctured. Antennæ slender, as long as the body. Abdomen smooth, shining, narrower than the thorax. Fore tibiæ, fore tarsi, and tips of fore femora testaceous; posterior tibiæ testaceous towards the base; hind femora and hind tibiæ slightly dilated. Wings and veins whitish; costal vein black exteriorly; stigma pale lurid, bordered by piceous veinlets. Length of the body $1\frac{1}{2}$ line; of the wings 3 lines.

SPATHIUS BISIGNATUS. *Mas.* Rufus, glaber, cylindricus, capite globoso, antennis pallide rufis apice nigris corpore non brevioribus, abdomine fusiformi, pedibus piceis, tarsis testaceis, alis anticis nigris perangustis albo quinque-notatis apice cinereis. *Fœm.* Niger, antennis corpore longioribus, abdomine clavato.

Male. Red, smooth, shining, cylindrical. Head globose. Antennæ pale red, filiform, slender, black towards the tips, as long as the body. Abdomen convex, fusiform, much longer than the thorax. Legs piceous; tarsi testaceous. Wings very narrow. Forewings black, with a white band near the base, and with four white dots, two on the costa, one in the interior part of the disk, and one on the hind border opposite the first on the costa; tips cinereous. Hind wings limpid. *Female.* Body black. Antennæ a little longer than the body. Abdomen clavate. Ovipositor as long as the abdomen. Length of the body $2–2\frac{1}{4}$ lines; of the wings 3 lines.

This species in structure comes between *Spathius* and *Hecabolus,* differing slightly from both genera.

SPATHIUS SIGNIPENNIS. *Fœm.* Rufus, gracilis, scitissime punctatus, capite transverso pallide luteo, antennis pallide luteis corpore paulo longioribus apice nigris, abdomine piceo subclavato, oviductu brevi, pedibus pallidissime flavis, alis albidis, venis nigris, stigmate flavo longissimo.

Female. Red, slender, hardly shining, very finely punctured. Head transverse, pale luteous. Antennæ pale luteous, slender, filiform, a little longer than the body, black towards the tips. Abdomen piceous, subclavate, pale beneath, a little longer than the thorax. Ovipositor less than half the length of the abdomen. Legs very pale yellow. Wings whitish. Fore wings moderately broad; veins black; veinlet between the subcostal and præbrachial veins very strongly marked; stigma yellow, very long. Length of the body $1\frac{3}{4}$ line; of the wings 3 lines.

This species differs from the preceding one and from *Spathius*

and *Hecabolus* as much as the two latter genera differ from each other.

Genus Heratemis.

Mas. Corpus glabrum. Caput transversum, thorace latius. Palpi graciles, longiusculi. Antennæ graciles, filiformes, corpore vix duplo longiores. Thorax robustus. Abdomen sessile, lineare, depressum, angustum. Pedes longi, graciles.

Male. Nearly allied to *Cœlinius.* Body smooth, shining. Head transverse, broader than the thorax. Palpi slender, rather long. Antennæ slender, filiform, almost twice the length of the body; joints elongate, numerous, closely joined together. Thorax robust; sutures of the parapsides strongly marked. Abdomen sessile, linear, depressed, a little longer and much narrower than the thorax. Legs long, slender. Wings moderately broad; fore wings like those of *Cœlinius* in the structure of the veins.

Heratemis filosa. *Mas.* Rufa, capite nigro, antennis nigris basi pallide rufis, pedibus testaceis, tibiis tarsisque posticis nigris, alis nigricantibus, venis stigmateque nigris.

Male. Red, paler beneath. Head black. Antennæ black, pale red at the base. Legs testaceous; hind tibiæ, hind tarsi, and tips of hind femora black. Wings blackish; veins and stigma black. Length of the body 2¼ lines; of the wings 4½ lines.

Genus Nebartha.

Mas. Corpus gracile, elongatum, scitissime punctatum. Caput transversum, sat parvum. Palpi graciles, longiusculi. Antennæ filiformes, sat graciles, corpore breviores; articuli elongati. Thorax fusiformis. Abdomen fusiforme, subsessile, thorace vix longius. Pedes longi, graciles; postici robusti, longissimi.

Male. Allied to *Cœlinius.* Body slender, elongate, slightly shining, very finely punctured. Head transverse, hardly as broad as the thorax. Palpi slender, rather long. Antennæ filiform, rather slender, shorter than the body; joints elongate. Thorax fusiform; metathorax well developed. Abdomen fusiform, subsessile, as broad as the thorax, but hardly longer. Legs long, slender; hind legs robust, very long. Wings moderately broad; structure of the veins hardly differing from that of *Cœlinius.*

Nebartha macropodides. *Mas.* Fulva, capite gutta nigra, antennis piceis basi fulvis, thorace abdomineque nigro bivittatis, femoribus intermediis nigro fasciatis, femoribus posticis dimidio apicali nigro, alis obscure cinereis, venis nigris, stigmate pallide piceo.

Male. Tawny. Head with a black dot between the eyes. Antennæ piceous, tawny at the base. Thorax and abdomen with a black stripe along each side. Middle femora with a black band near the tips. Hind femora with the apical half black. Wings dark cinereous; veins black; stigma pale piceous. Length of the body 2¾ lines; of the wings 4½ lines.

Genus Psyttalia.

Fœm. Corpus convexum, glabrum, latiusculum. Caput transversum, thorace non latius. Antennæ graciles, filiformes, corpore longiores; articuli breves. Scutum subcarinatum. Abdomen ellipticum, subsessile, thorace paulo longius non angustius. Oviductus brevis. Pedes breviusculi.

Male. Body convex, smooth, shining, rather short and broad. Head transverse, as broad as the thorax. Antennæ slender, filiform, longer than the body; joints short, numerous. Scutum with a slight keel. Abdomen elliptical, subsessile, as broad as the thorax and rather longer. Ovipositor shorter than the abdomen. Legs rather short. Fore wings rather broad; veins in structure somewhat resembling those of *Pygostolus*, to which genus the following species seems to be nearly allied.

Psyttalia testacea. *Fœm.* Testacea, mandibulis apice nigris, antennis piceis, basi testaceis, oviductus vaginis nigris, alis cinereis, venis nigris, stigmate pallide piceo.

Female. Testaceous. Mandibles with black tips. Antennæ piceous, testaceous at the base. Sheaths of the ovipositor black. Wings cinereous; veins black; stigma pale piceous. Length of the body 2 lines; of the wings 4 lines.

[To be continued.]

XXXVI.—*Reply to* Mr. Jeffreys's *Remarks on a "Note on the Comparative Size of Marine Mollusca in various Latitudes of the British Seas."* By Robert M'Andrew, F.R.S., F.L.S.

Mr. Jeffreys, in the wish to substantiate his proposition that "in general, the size of specimens (of Mollusca) increases in a ratio inverse to their northern and converse to their southern points of latitude," having thought fit to contradict some of my statements, and endeavoured to throw discredit upon others, I feel called upon, very reluctantly (anything in the shape of controversy being opposed alike to my habit and inclination), to revert once more to the question, in order to show that such a proposition not only has not been proved, but is at variance with fact.

I cannot boast the advantage of having dredged in extreme northern or southern latitudes, my researches having been confined within about forty-two degrees of latitude, or some ten degrees north and twenty degrees south of the extreme limits of the British seas; but trust that my opportunities have been such as to make me competent to form an opinion upon the point at issue,—the conclusion I have come to regarding it being entirely the result of personal observation.

Mr. Jeffreys professes to consider *seriatim* all the instances adduced by me as opposed to his theory, but has omitted to notice the following ten,—*Pecten Islandicus, Margarita alabastrum, Astarte arctica, A. incrassata, Fusus antiquus, Triton nodosum, Lucina spinifera, Murex brandaris, Cypræa lurida,* and *C. spurca.*

In consequence of Mr. Jeffreys's remarks (some of which surprised me not a little), I have carefully reconsidered the whole of my statement, comparing specimens together where necessary, and now give the result as follows :—

1. *Corbula nucleus,* from North Drontheim. Mr. Jeffreys's remark would be equally applicable to specimens obtained in the Mediterranean or other southern localities. It is just possible that Mr. Jeffreys may not be aware that North Drontheim is an extensive province of Norway, with a very great range of seacoast, and that he may have supposed my specimens to have been obtained in one particular locality.

2. *Trochus lineatus.* It is probable that Mr. Jeffreys has not seen my specimens from the neighbourhood of Vigo (obtained in 1857 by Mr. Woodward and myself), or he would not have coupled them with those from Mogador. I wish, however, to correct my statement respecting this species, and only to say that the specimens from the neighbourhood mentioned exceed in size the ordinary specimens on the British coasts.

3. *Astarte sulcata* I have not found to vary in size more than most other species of Mollusca,—much less than its congener *A. compressa.* I adhere to my statement that it diminishes in size when traced northward from the Scottish coasts to those of Finmark.

4. *Astarte triangularis.* Mr. Jeffreys believes that he can match, in point of size, specimens from North Britain with any of mine from Gibraltar Bay, which is of course possible; but the fact still remains unimpeached that *all* my specimens from Gibraltar (and they are very few) exceed in size the largest I have obtained in Britain. I have procured it off Scilly, as well as from many localities of Scotland, and at various depths, varying from three to sixty fathoms.

5. *Crenella marmorata.* It is possible that Mr. Jeffreys may have been misinformed respecting the large specimens he saw being from Greenland, as I find no mention of it in Möller's or Mörch's catalogues of the shells of that country; nor was it among the species dredged there by Mr. Barrett. Indeed it has never been met with, to my knowledge, in the Arctic seas.

6. *Crenella rhombea.* The ordinary run of specimens from the Canary Islands is considerably larger than any I have seen obtained in Britain or the Channel Islands. The comparison

has not yet been made between the largest in Mr. Jeffreys's possession and in mine.

7. *Nucula nucleus.* My specimens from Norway are of the ordinary British form, and are no more a small variety than are those from Spain and Portugal.

8. *Nucula decussata.* I cannot but think that Mr. Jeffreys must be labouring under a mistake; otherwise his specimen from Oban must be very extraordinary, and quite exceptional in its dimensions. Of the few specimens I obtained off Malaga, the largest measures about seven-eighths of an inch in its greatest diameter; the largest of many specimens obtained off Oban at various times is smaller by about an eighth of an inch.

9. *Cardium rusticum.* All the British specimens I have seen of this species are from South Devon. Upon one occasion, after an equinoctial spring-tide and gale of wind, I saw such quantities of this species, in company with *C. aculeatum*, thrown upon the shore of Torbay in a living state, that they might have been collected by the bushel. The specimens of both species, but more particularly *C. rusticum*, are much smaller there than at Gibraltar and in the West Mediterranean.

10. *Cardium papillosum* I have not met with north of Vigo, where the specimens are smaller than in the Mediterranean: size of latter five-eighths of an inch, or rather more. I should like to know the exact dimension of Dr. Lukis's specimen—if, indeed, the species is identical; though, in any case, a single specimen could not give much weight to an argument.

11. *Cardium pygmæum* I have taken in the south of Ireland (Cork Harbour), as well as various British localities, but in none so large as the average of those in Vigo Bay. It should be borne in mind that the question is regarding the size *generally* attained by species in the different latitudes.

12. *Venus verrucosa.* Mr. Jeffreys would appear to have seen only small specimens from southern localities. My British specimens were from Pwllheli, where, as the most northern limit of the species, according to Mr. Jeffreys's theory, the largest specimens ought to have been found. The Rev. Mr. Norman, with a view to improve my specimens, very kindly sent me others, which I may presume to be at least equal to the average in size; but these, as well as all the other British specimens I have seen, are decidedly smaller than the average of adult specimens from Gibraltar, and of those which are taken abundantly from Minorca to be sold as food in the market of Algiers.

13. *Mactra stultorum.* It is very possible that Mr. Jeffreys may be correct in his suspicion that the specimens alluded to by me may belong to *M. inflata* of Bronn, though I much doubt their being specifically distinct.

14. *Littorina rudis.* I do not question the correctness of Mr. Jeffreys's remarks, but do not see that they in any way affect my statement.

15. *Scalaria communis.* Notwithstanding that Mr. Jeffreys has not seen large Mediterranean specimens, it is nevertheless a fact that they attain a greater size in Gibraltar than in England. The largest of my Gibraltar specimens exceeds in size the largest of my English, and the average of my Gibraltar the average of my English specimens.

16. *Bulla hydatis.* I refer to the shell so called by Forbes and Hanley (whether correctly or incorrectly named is not to the purpose), which is both abundant and large at Vigo Bay.

17. *Murex erinaceus.* I may have given small specimens to the British Museum. I repeat that the species attains larger dimensions upon the coasts of Spain than on those of Britain, both as regards extreme and average magnitude.

18. *Cerithium reticulatum.* I will not enter upon the question of varieties. I wish, however, to amend my remark upon this species, and to substitute—that the Spanish specimens are fully equal in size to the British, and larger than those of North Drontheim.

19. *Triforis perversa.* I do not see how Mr. Jeffreys's remark upon the last species applies to this. I repeat that the specimens of it attain much greater size in the Mediterranean than on the British coasts.

20. *Aclis supranitida.* I acknowledge that I was mistaken in my remark regarding this species. Upon comparing my only Madeiran specimen with British, I find it to be about equal, but not superior, in size.

Mr. Jeffreys's information respecting *Tellina balaustina* is only important with reference to the distribution of the species. The result of my observation is limited to the fact that specimens diminish in size but increase in frequency from the Atlantic eastward in the Mediterranean.

Of *Teredo*, I am unacquainted with the species. Montagu, who probably confounded more than one species under the name of *Teredo navalis*, speaking of it, says, "This part (the tube) is rarely above three-quarters of an inch in diameter at the larger end, and a foot in length in our climate, but exceeds that in the more southern parts, from whence it was brought into our harbours, to the great destruction of our ships—as Linnæus justly observes, *calamitas navium.*" It is certain that ships are much more exposed to the ravages of these animals when in southern latitudes; and it is evident that before the custom prevailed of protecting the bottoms of ships with copper, the transportation of species from their original habitat to the remotest regions was inevitable.

Mr. Jeffreys, choosing his own ground, and taking the British Mollusca as a standard of comparison, names certain species "in particular" as appearing to attain a larger size in our own seas than in the south of Europe. I must say that he has not been fortunate in the selection. *Donax politus* may possibly acquire larger dimensions in Britain than in the Mediterranean, though, upon comparing my specimens, I find but little difference between them. *Rissoa striatula* is very rare: I have never obtained an adult specimen in the south, and have no reason to believe that it does not attain as large size in Cadiz as in England. *Avicula Tarentina* I have never myself obtained in the British seas, and rarely in the Mediterranean. Forbes and Hanley mention that the largest specimen they have seen measures nearly four inches in length; my largest of very few specimens from Malaga measures barely three and a half inches. *Galeomma Turtoni* is a rare species, of which I have taken but very few specimens, principally in the north of Spain; but it so happens that the individual I have found furthest to the south (in the Great Harbour of Syracuse) is larger than any I have seen from the Channel Islands or elsewhere. Of *Murex corallinus* I have twice received specimens from the Channel Islands, through the favour of Mr. Jeffreys; but they are inferior in size to the average of those from the Bay of Gibraltar. *Trochus striatus* attains something like double the size in the Mediterranean that it does in the British seas; and my specimens of *Lachesis minima*, both from the north of Spain and the Mediterranean, are about five times as large as the British—more than double the length, and thick in proportion. Forbes and Hanley state the ordinary length to be one-fifth of an inch, which exceeds the size of my British specimens; while the Spanish are seven-sixteenths of an inch in length.

It would be foreign to my object to argue in favour of the geographical zones into which that part of the ocean which washes the shores of Europe has been divided by naturalists; but it strikes me that he must be a bold man who would assert, for instance, that the Arctic Sea has no existence in fact or in nature, or that there are not species of Mollusca to which it affords the natural habitat, and which degenerate or cease to exist in warmer regions. The Temperate zone, occupying so much greater range of latitude in our hemisphere than either the Arctic or the Torrid zones, it has been found convenient to divide upon the coasts of Europe into north-temperate or Boreal, mid-temperate or Celtic, and south-temperate or Lusitanian; and I conceive it would not be difficult to show that each of these affords the climate and conditions best adapted to peculiar forms and species of Mollusca.

Though I do not pretend to compete with Mr. Jeffreys as a collector of British shells, I have possessed greater opportunities of collecting native species than of the shells of foreign countries. Having devoted more time and labour to our native species, my cabinet is proportionately better furnished with them; consequently I cannot agree with Mr. Jeffreys as to the cause of the difference between us, and the error into which one of us has fallen, but concur with him in the hope that further experience will show which of our conclusions is correct.

Having now gone over Mr. Jeffreys's remarks, paragraph by paragraph, it remains for me to add that I have stated nothing as fact which I am not prepared to prove by reference to specimens in my own cabinet. I mentioned in my last communication, and I repeat it now, that nothing could be easier to me than to multiply instances in support of my views, but conceive that my doing so now would be a waste of time, as I have cited sufficient for the purpose.

In conclusion, I beg to remark that, in order to sustain the theory propounded and advocated by Mr. Jeffreys, it should be proved to hold good both within and without the Mediterranean: it should be shown that the Mollusca of the coasts of Piedmont (situated only six or seven degrees south of the southernmost shores of England, and one or two degrees north of Vigo) are larger in size than the Mollusca of the Mediterranean generally; they should be as much larger than the specimens of Gibraltar and Malta as they are smaller than the British. I would also suggest that the British seas extend through above ten degrees of latitude, and have been more thoroughly explored than any other part of the world of similar extent; and if Mr. Jeffreys's proposition held good within their area, it could hardly have escaped the notice of the numerous collectors and naturalists who have made our coasts the scene of their labours.

BIBLIOGRAPHICAL NOTICES.

Handbook of the British Flora. By G. Bentham, F.L.S. London: Lovell Reeve. 1858.

A few years since, the Flora by Hooker and Arnott was the textbook and rallying point of that "school" of English botanists who professed to remain satisfied with a moderate subdivision of species, and were disposed to defer accepting, until tested by cultivation, the so-called "sub-species," which have been generally adopted as species upon the European continent, and which had to some extent been recommended to the British student in Babington's Manual.

The followers of Hooker and Arnott let us call by way of illus-

tration the "Conservatives," then those of Babington will represent the "Liberal" or "Progress" party.

Such were in the main the respective positions of the two schools five years ago; and many of our best local botanists thought that the *combining* process had been used too freely by the "Conservatives."

Now a step diverging still further has been taken on either side: Bentham's Handbook is, in its estimate of the *number* of British plants, even more remarkably different from Hooker and Arnott's Flora than the latter work is from Babington's Manual. Mr. Bentham's views will represent a third section, which may be termed (from its attachment to ancient precedent) the "High Tory" party, as the minutely-examining school of Alexis Jordan of Lyons will in turn represent the "Radical Reformers," hardly numerous or yet popular, botanically, with us. Those who prefer to rely upon individual opinion will be the "Free-thinkers" in botany.

As in politics, each of these parties has its use; and their different manner of viewing the question arises naturally out of their method of study.

The physiological botanist is more likely to see resemblances than differences; for he traces the unity of plan and analogy of function through all the endless varieties of plants.

The geographical botanist, too, from the very nature of his studies, requires a certain amount of simplicity (would that we could say *uniformity*!) in the value of species. He cannot hope to follow *over-refined* "splits" through their whole range, when some of them are only just announced from a few scattered localities, and when it may require years of study, and a greater increase in the number of accurate observers than could be expected, before anything certain can be known of their distribution.

Hence the "Conservative" school derives no small part of its credit and importance from the high names which are associated with it. But that the study of geographical botany is not altogether opposed to the exact discrimination of species, is sufficiently proved by the example of Mr. H. C. Watson, who, in his 'Cybele Britannica,' walked nearly hand in hand with Babington's successive editions; but it must be remembered he was working in a limited field of observation.

In his more manageable "field," the local botanist of inquiring mind, who has leisure and taste for such studies, will be found carefully tracing out all these minutiæ, not necessarily with the view of founding new species, but with the desire of acquiring a knowledge of his plants as exact as possible. Nor is he by any means to be called a useless contributor to the science. He often shows the way to some species hitherto overlooked; it is to him we are usually indebted for an intimate knowledge of varieties, and especially of "Hybrids;" and, more than to any other, for the detection of new localities for the Linnæan species. Thus it is not to be wondered at if we find Babington's Manual the favourite text-book with the most advanced of British botanists.

After all, it may be but a matter of choice whether, from opportunities of travel, or of consulting herbaria and botanical gardens, we endeavour to master many distinct forms (let us say "sub-genera"), or turn our attention to the thorough discrimination of what lies close at our feet. An equal amount of labour may be given in either case, and, if conscientiously bestowed, not lost.

These remarks will have prepared our readers to expect, from a botanist of the experience of Mr. Bentham, views of a decidedly collective tendency. His estimate of the value of a species he considers as founded upon the "Linnæan" standard: and certainly this plan offers many *conveniences* to the general and geographical botanist. We know further, from his paper read before the Linnæan Society in March 1857 (Journal of Proceedings, ii. 30), that our author is prepared to take the same course with respect to the *genera* and *orders*, so far as established by Linnæus, as he recommends a return to the use of them also, "*for the purpose of language*," and to give to the subordinate groups of suborders and subgenera a sectional value only, with *no names at all*.

This course Mr. Bentham considers the only escape from the inevitable confusion and ever-increasing difficulties which arise from the daily addition of new names.

Now we do not pretend to say whether, as regards species, this is to be considered as merely the philosophical view of a botanist of large experience, or whether such a plan equally recommends itself from the facility which it affords to the young student of English botany. The High Tory leader, however, as sometimes happens in politics, addresses himself to the illiterate class. Here we cannot help suspecting that our author is smoothing the road for the beginner where he has travelled too cursorily himself.

The professed object of Mr. Bentham is to render the student's first steps as easy as possible: that he should afterwards complete his studies in a more exact school is implied; and, indeed, without this, he would soon lose interest, if he should wish to confine his attention to British botany.

The means used to facilitate the beginner's studies are:—

1. Condensation of species to the supposed standard of Linnæus, or beyond it.
2. The use of the dichotomous method of Lamarck, as an analytical key to the orders, genera, and species. (This is likely to prove the most successful part of the book.)
3. Simplicity, and English terms, as far as possible, in the descriptions; and *English names* for the orders, genera, and species.
4. A concise, and eminently lucid, introduction to the knowledge of the structure of plants, and of the terms employed in their description.

The following is Mr. Bentham's definition of a *species*:—It "comprises all the individual plants which resemble each other sufficiently to make us conclude they are all, or may have been all, descended from a common parent. These individuals may often differ from each other in many striking particulars, such as colour of the flower,

size of the leaf, &c.; but these particulars are such as experience teaches us are liable to vary in the seedlings raised from one individual.

"When a large number of individuals of a species differs from the others in any striking particular, they constitute a *variety*. If the variety generally comes true from seed it is often called a *race*. A variety can only be propagated with certainty by grafts, cuttings, bulbs, buds. . . . A *race* may with care be propagated by seed, though the seedlings will always be liable to lose those particulars which distinguished it from the rest of the species.

"A REAL SPECIES will *always* come true from seed" (p. 26 of Introduction). We hope the test of careful cultivation is rigorously carried out at Kew or elsewhere, under the accurate and observant eye of our author; otherwise, he is only setting problems without attempting to solve them himself, or even ascertaining if they admit of solution.

One of the most distinctive features of the 'Handbook' is the prominence given to English names. As in the standard series of zoological works published by Van Voorst, the English specific names take precedence of the Latin: here our author abjures his own principle of "ancient precedent."

Perhaps in those Utopian days when botany shall be taught in every village school, Mr. Bentham's English names may obtain general currency. At present they seem to add one more difficulty to a synonymy already encumbered. An experiment which has failed among the French (a nation never the last to adopt a desirable novelty) is hardly likely to succeed upon the more conservative side of the Channel.

Great pains have been bestowed upon an idea which, like the decimal system of coinage, must find a most serious obstacle to its introduction in long-continued use, even if the advantages offered by the adoption of English names were not far outweighed by other considerations, such as the reason above given.

Another novelty to British botanists is the outline of its foreign range, which is given after each species, as well as a general summary of its distribution in Britain; the latter derived from Mr. Watson's 'Cybele Britannica.' But views that condense many plants under one name lead naturally to inexact views of geographical distribution, and we should not be surprized to find that the range of many species is made to appear wider than it really is.

The introduced plants, "aliens," &c., receive little favour at the hands of Mr. Bentham; and here we believe he has acted very judiciously. The thoroughly naturalized plants, however, as well as the colonists, stand, in the text, upon equal terms with the indigenous species: we regret that our author did not conform to the practice, so usually adopted, of distinguishing these interlopers by some "brand" indicative of their foreign origin, assumed or known.

It is well observed of the "colonists," that "in some instances it would appear that the whole of the land they originally inhabited is now in a state of cultivation; so that if omitted from one *Flora* they

must, for the same reason, be rejected from almost every other one,"—an argument, by the way, which has been employed to account for our ignorance of the original "*specific centres*" of the cereals themselves.

Great stress is laid upon judging of the claims of plants to be regarded as natives from the knowledge of their whole "*area*," or general distribution, much in the same way as recommended by Alphonse DeCandolle; but those who have perused the fourth volume of Mr. Watson's 'Cybele' are aware how much there is to be said upon the other side about the high importance to be attached to the "*nature of the station*" and to the circumstances under which the suspected plant occurs. As often remarked, allowance must also be made for the extreme rarity of some species that are probably natives, though with us at the outskirts of their range, or become very much rarer than was formerly the case by the cultivation and drainage of land.

The 'Handbook' is no mere compilation, for its author tells us he has conscientiously re-examined his plants, and compared them *with Continental specimens* of the same species.

We have some misgivings whether the tyro is likely to acquire a just appreciation of the value or limits of a species when he is taught to include under one name no less than five plants (as in the case of *Cerastium vulgatum*), which amounts to little more than recognizing a subsection or subgenus. We suspect that the beginner's belief in the existence of a species at all will be not a little shaken when he gathers, growing side by side, two plants so different as *Cerastium glomeratum* and *C. semidecandrum*, and yet is told they are identical. Nevertheless, no proof has been adduced from cultivation; no intermediates occur among hundreds of both kinds; and at the same time nearly all systematic botanists are agreed to believe that a species has limits somewhere, though we may not yet have found them. The conflicting opinions on this subject, even within the bounds of a Flora so small as that of Britain, sufficiently show that it is not in books we must look for these limits.

We have space for only a few instances of Mr. Bentham's sweeping combinations, for most of which no reason is given, except the opinion of the author, or the authority of some eminent, but often ancient, writer.

We much regret this omission, as it can hardly be expected that the "Liberal" or "Progress" party, far less the "Radicals," will submit to such despotic assumptions without ample proof.

There is but one *Arctium*. Ah, lucky tyro! how we envy him a load of difficulties removed at one stroke of the pen!

The *Ranunculi*, of the *Batrachium* section, are all swamped under one species; but if we have our old friend *R. aquatilis* restored to its ancient dignity, it must feel somewhat alarmed at finding itself at the head of a larger family than it ever acknowledged before.

Similar amalgamations will be found under *Potamogeton pusillus*, which now includes a whole section of narrow-leaved species.

Potamogeton natans is joined to *P. oblongus*, and also to *P. plan-*

tagineus. But, in the case of some of the other species, we commend Mr. Bentham's views to the careful study of the minutely-examining botanist. Aquatics, above all other plants, are liable to variation, and much remains to be learned in the genus *Potamogeton* concerning the effect of stagnant or running, deep or shallow, fresh or brackish water.

Carex distans includes no less than four others.

C. arenaria takes in *C. intermedia.*

C. axillaris is united (unwillingly, we are sure) to *C. Bönninghausiana,*—a combination against which we strongly protest, as it seems to us that the latter is far more nearly related to *C. paniculata.*

Galium uliginosum joins *G. Witheringii; G. pusillum* joins *G. saxatile*; *Salicornia radicans* is lost under *S. herbacea*; and many more instances might be quoted, but the details are so completely and clearly given in the sixth chapter of the 'Cybele Britannica,' vol. iv., that it is needless to repeat them here.

Other pairs of species have been treated more tenderly. *Valerianella carinata* continues separate from *V. olitoria*; *V. auricula* from *V. dentata. Orchis latifolia* is allowed to pass as distinct from *O. maculata*; *Polygonum Persicaria* from *P. lapathifolium*; *Myosotis sylvatica* from *M. arvensis.* It may be asked, "Why should not these have fared like the former?" We think that here is only one proof more that there is no means of dividing equidistantly species which are not the links of a linear series, and which are hardly better likened to the knots which join the meshes of a net. Might we not say that they may more resemble variously intersecting lines of dots spread over a sphere so as to display in all their affinities, resemblances, and analogies, the unity of plan which existed in the *mind* of the One Creator, rather than the necessity that we should consider His creatures descended from *a few main types*?

We take leave of Mr. Bentham's 'Handbook' with a ready acknowledgment of the many novelties which he has introduced for the first time to the English student of botany, and with the hope (not without considerable misgiving) that his book may be found as useful a guide to the beginner as could be wished by its accomplished author.

May it induce many to enter the ranks of the votaries of our gentle and instructive craft; for indeed there is work and pleasure enough for all.

First Traces of Life on the Earth; or, the Fossils of the Bottom-rocks. By S. J. Mackie, F.G.S. &c. Groombridge, 1860.

The study of Geology introduces us to many different stages in the Earth's history, where we may behold more or less distinctly the several successive phases which this planet has, time after time, put on. The masters in the science, the professional geologists, and the amateurs have all contributed to the accumulation of the facts and the construction of the theories whereof the science now consists, and by the aid of which the graphic portraiture of the earths's earlier

features and inhabitants is now so often attempted. Mr. Mackie's treatment of the subject to which he has devoted this little book is careful and judicious. It is a subject, in one sense, far removed from actual observation; for the first animals and plants that lived upon the earth have so long passed away, that we know not whether the oldest fossils that we meet with be indeed the remains of the oldest creatures. Taking for granted, however, that the lowest fossiliferous rocks now known represent the earliest sediments of life-bearing waters—that their modes of deposit indicate the nature of the coasts and sea-bottoms of primeval geography—that their materials point to the character of the adjacent land—that their obscure fossils, often mere marks and holes, can be made to give a full and certain meaning,—we may with advantage study the author's sketches of the primeval lands and "of the first forms of the organized creatures which inhabited it—the forms of those abundant tribes whose offices played the first important part in the past conditions of our planet, and whose remains are characteristic of our lowermost rock-masses."

For those who know not on what principles a geologist works in mixing his colours, stretching his canvas, handling his pencil, and bringing up the features of the forgotten past with nature's tints, Mr. Mackie provides some clever chapters on "the nature of fossils," "the value of fossils," "the order of the rocks," "what we know of the earth's crust," and on "the rock-strata and their teachings." The reader will here find most of the chief principles of geological science briefly but clearly stated,—especially the very necessary doctrine that Nature's operations of to-day illustrate the results of natural agencies, atmospheric, terrestrial, and aqueous, in past times. Thus "we see in the microscopic structure of many of those finer silicious rocks which are composed of an aggregation of the solid cases of Infusoria, and of limestones composed of nearly equally minute Entomostraca and Foraminifera, the slowly formed life-elaborated produce of the tranquil lake, or of the profound abysses of the deep. Our ponds and inland seas give us the key to the one, the soundings for the great Atlantic telegraph that to the other. The silent language of the past, in which these facts are written, appears at first strange and unintelligible, as the tongue of our Saxon forefathers does to us now. But as the languages of the ancient peoples are interpreted by our own and by those of contemporary nations, so the events and changes of the past conditions of our planet can be understood only by comparison with the phænomena going on around us."

The outlines of the first dry lands, and the remnants of them now here and there to be found—how their wearing-away gave rise to sediments which, as hardened quartzose schists and slates, now yield scanty evidence of primeval life (sea-worms, Zoophytes, and a few Crustaceans perhaps)—how the wind and rain and sunshine played on the long, flat, sandy ooze of those old shores,—these are the points and features which take prominence in the geological sketch before us. With a facile touch the artist has coloured in the dreamy

vision—"the first-born lands of our mother-earth joyously basking in the smiles of the sun, bathed in the tear-drops of the clouds, and scarred with the blasts of the waves and the storms." His composition is founded on the well-based theories of the 'Principles' and 'Siluria;' and the judiciously chosen colours on his canvas have been supplied by the proved researches of modern geologists.

The author's style is florid, but often good; and, though objections may be made to occasional loose or obscure passages, to the too widely printed pages, and to the pompous classification of the woodcuts as "plates" and "lignographs," yet we recommend this little book as well worth the attention of geologists, students, and others: it has numerous woodcut illustrations, some of them of superior execution.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

December 22, 1859.—Sir Benjamin C. Brodie, Bart., President, in the Chair.

"On the Structure of the *Chorda dorsalis* of the Plagiostomes and some other Fishes, and on the relation of its proper Sheath to the Development of the Vertebræ." By Professor Albert Kölliker, of Würzburg.

I take the liberty to present to the Royal Society the results of an extended series of investigations into the development of the vertebræ of the plagiostomous and some other fishes.

I. *Chorda dorsalis.*

A. *Structure.*

The chorda dorsalis of the Plagiostomes, of *Chimæra*, *Acipenser*, *Scaphirhynchus*, *Toxodon*, and *Lepidosiren*, shows *four* distinct parts, viz.—

1st. The *outer elastic membrane*, a homogeneous elastic coat, which is not unfrequently perforated with holes of different sizes, of the same kind as those of the fenestrated membrane of Henle.

2nd. The *proper sheath*, formed of connective tissue of fibrous appearance, and generally provided with many plasm-cells.

3rd. The *inner elastic layer*, a reticulated elastic membrane; and

4th. The *gelatinous substance* of the chorda itself, made up of soft cartilage-cells, of different sizes and generally provided with nuclei.

Of these four layers it would seem that only the third and fourth are present in the higher animals, from the Amphibia (with the exception of the Batrachians) upwards; if, at least, my opinion be correct, that the structureless envelope of the chorda of these animals, generally called the sheath proper, corresponds to the third layer in the cartilaginous fishes. On the other hand, it seems that many of

the osseous fishes present the same complications of structure as the Plagiostomes, if it is true that the bodies of their vertebræ are developed from the proper sheath of the chorda. So, for instance, there exists a beautiful elastic internal layer outside of the remnants of the gelatinous chorda in the genus *Orthagoriscus*.

B. *Form of the chorda proper.*

1st. The chorda retains in some instances its original cylindrical form; and this is the case when the vertebral column shows no indication of vertebral bodies (Cyclostomes, *Acipenser*, *Chimæra*, *Lepidosiren*, *Tilurus*, *Hyoprorus**—anterior vertebra), as well as where vertebral divisions exist (*Leptocephalus*, *Helmichthys*, *Hyoprorus*—last vertebra).

2nd. In other cases the chorda is contracted in the middle region of each vertebral body, which seldom happens where there is no trace of ossification (*Hexanchus*), but is very generally the case in ossified vertebræ (Squali, osseous fishes, perennibranchiate amphibia, *Cœciliæ*).

3rd. Lastly, the chorda may be separated into as many parts as there are interstices between the vertebræ, which remaining parts in some cases are totally absorbed (*Raia* and most of the higher animals).

C. *Anterior end of the chorda.*

1st. In many full-grown fishes the chorda dorsalis reaches with its anterior attenuated end to the base of the cranium, and its cranial part is in some cases enveloped in its whole length by the cranial cartilage. This fact has been long known with regard to the Acipenseridæ, Cyclostomi, and Sirenoidei; but the same thing occurs amongst the Squali, and has been observed by Stannius in *Prionodon*, and by me in *Heptanchus*, *Centrophorus*, *Acanthias*, and *Squatina*. In these last fishes the chorda reaches as far as the region of the hypophysis, and is bent upwards at its termination, so that the end itself lies underneath the interior perichondrium of the cranium, or at least very near the surface of the cartilage. In other cases only the hinder part of the chorda is enclosed by the cranial cartilage, whilst the anterior half lies in a groove at the under part of it, as in *Leptocephalus* and *Helmichthys*. In one case (*Tilurus*) the whole cranial part of the chorda is free, and situated underneath the base of the cranium, between its cartilage and the perichondrium†.

2nd. In some genera of Squali and most of the osseous fishes, the cranial part of the chorda is reduced to the anterior half of the first ligamentum intervertebrale.

3rd. In the genus *Chimæra*, the chorda ends in the foremost part of the vertebral column. In this case the connexion between the

* Two genera belonging to the Leptocephalidæ, described by me (see Kaup, Apodal Fishes of the British Museum. London, 1856).

† In all these fishes there exists rather a strong connexion between the vertebral column and the cranium; in *Squatina*, besides this there are two lateral articulations between the cartilaginous arches of the first vertebra and the lateral parts of the cranial cartilage.

cranium and the column is maintained by an articulation, which on the side of the column is formed by the cartilaginous vertebral arches.

4th. In the Raiidæ, finally, the chorda ends at a greater distance from the skull; and in this case also the anterior part of the column, which is formed only by the coalesced arches, is connected with the cranium by a real articulation.

II. *Ossification and Development of the Bodies of the Vertebræ.*

A. *General remarks on the part which the chorda takes in the formation of the vertebræ.*

1st. In all cases where the chorda ossifies, it is only its second layer, or the *sheath proper*, which undergoes changes. At the same time the elastica externa disappears totally, or is at least dissolved in such a manner that its remnants are scarcely distinguishable, whilst the elastica interna and the chorda proper generally remain unaltered. In one case only, viz. in *Scymnus lichia*, ossification is to be seen even in the gelatinous substance of the chorda.

2nd. The ossification of the sheath of the chorda has been observed as yet only in the Plagiostomes and in certain genera of the osseous fishes; but very probably it will be found in all osseous fishes. On the contrary, it is absent in all higher Vertebrata,—according to my observations, even amongst the Batrachia.

B. *Changes of the sheath of the chorda during ossification.*

1. *Vertebral column.*

1st. In the Plagiostomes the sheath of the chorda in the first place assumes a greater hardness in certain parts, these parts being transformed into fibro-cartilage or real cartilage, whilst the intervening parts retain their primitive softness. In this manner the first indications appear of the vertebral bodies and intervertebral ligaments, the interior parts of which are formed by the chorda itself and the elastica interna. The histological changes going on during this formation of the vertebral bodies, viz. the transformation of the primitive plasm-cells of the sheath into cartilage-cells, and the development of the homogeneous interstitial substance of the cartilage out of the fibrous substance of the sheath, speak strongly in favour of the view that both kinds of cells and intervening substances are closely allied, whatever may have been the development of the elements of the primitive sheath.

In the *Leptocephali* the sheath of the chorda ossifies without having been transformed into cartilage; and the same seems to hold good for the other osseous fishes.

2nd. Whilst this transformation of certain parts of the sheath of the chorda into cartilaginous vertebral bodies is going on, there are also formed in the interior of each of these bodies peculiar vertical dissepiments. These dissepiments, developed by an interior growth of the sheath of the chorda, whereby the chorda proper becomes constricted, occur in some cases in vertebræ without any or with very

slight traces of ossification, as in *Hexanchus* and the anterior vertebra of *Heptanchus*, whilst they may be almost wanting in others pretty well ossified (*Leptocephalus*, *Helmichthys*, *Centrophorus*).

3rd. The ossification of the cartilaginous vertebral bodies formed out of the sheath of the chorda never begins at the surface, but always in their interior, and also in their middle region, and is (as far as I know, without exception) in the first instance a calcified fibro-cartilage, or what I call a fibrous bone.

4th. The first osseous parts have the form of thin *rings* (*Heptanchus*, anterior vertebra), which afterwards assume that of hollow and thin *double cones* (*Heptanchus*, posterior vertebra, *Centrophorus*).

5th. The growth of these double cones, which are the real osseous vertebral bodies, when once they have assumed their whole length, takes place especially at their *outer side*, through the addition of *calcified cartilage* (chondriform bone, Williamson; *Knorpel-Knochen* in German), which is formed from the outer chordal cartilage of the vertebral body. In addition to this, the osseous double cone thickens also at the expense of the cartilage inside of it, but in a much smaller degree.

6th. In some cases the outer growth is everywhere the same, and in this manner stronger double-coned vertebral bodies of uniform thickness are formed. In other cases the growth is in some parts more active than in others, and vertebral bodies then originate with outer ridges and lamellæ (*Heptanchus, Raia, Carcharias, Mustelus, Galeus*). In one single instance the ossification of the outer cartilage takes place in such a way that the exterior parts of the vertebral bodies are formed by alternating circles of chondriform bone and cartilage (*Squatina*).

7th. With regard to the extension of this growth of the vertebral bodies formed by the ossification of the sheath of the chorda, it is to be remarked that in some cases the whole, or nearly the whole sheath of the chorda ossifies, as in *Squatina* and the Raiidæ. In other cases greater or lesser parts of the primitive cartilage, inside and outside the vertebral body, remain in their primitive state (Squali).

2. *Skull.*

In some instances even *the sheath of the cranial part of the chorda ossifies* in its hindermost part, and *forms a true vertebral body for the occipital vertebra*, which entirely corresponds to those of the column. This has been observed by me as yet in *Leptocephalus* and several Squalidæ; but it is extremely probable that the *basilar occipital* of all osseous fishes, viz. that part of this bone which resembles a common vertebral body, is developed quite in the same way.

C. *On the manner in which the outer ossifying layer is concerned in the formation of the bodies of the vertebræ.*

1st. In those cases where the outer ossifying layer, viz. that layer in which the cartilaginous arches are developed, takes part in the formation of the vertebral bodies, there are to be distinguished two

different processes,—one in which the crural cartilages themselves play a part in this formation, and a second, where only the periosteal layer between them is concerned.

2nd. Where the crural cartilages take a part, they form, in the first place, by their coalescence an *outer cartilaginous layer* around the body of the vertebra, which took its origin from the chorda, and which we shall henceforth call *the chordal vertebral body.*

3rd. This outer cartilaginous layer ossifies in many cases; and this ossification may take place in *two* places only, viz. on the right and left side of the vertebral body, as in *Heptanchus,* or in *four* places, in which case a superior point of ossification at the floor of the neural canal, and an inferior one at the roof of the hæmal canal, are added to the two lateral ones (*Acanthias, Scymnus*).

4th. These external ossifications of chondriform bone may retain their primitive form of plates, and may then be called the lateral, superior, and inferior osseous plates; or they acquire by additional growth, at the expense of the outer cartilaginous layer, the form of wedge-shaped or cuneiform bodies, and may be named the lateral, superior, and inferior wedges (*Zapfen, Keile,* Germ.).

5th. In both cases these external ossifications comport themselves in two different ways with regard to the chordal vertebral body, inasmuch as in some cases both coalesce at their ends (*Scymnus, Acanthias*), whilst in others they remain separated (*Heptanchus*).

6th. In some peculiar cases (Squali, possessing a nictitating eyelid, viz. *Mustelus, Carcharias, Galeus, Sphyrna*) the cartilaginous arches remain separated, and then the intermediate periosteal layer performs the part of an osteogenic stratum. The osseous parts produced in this way lie at the same places as the bony plates mentioned under 4 and 5; they always possess the form of wedges, and coalesce with the chordal vertebral body, in some cases only at their ends, in others in their whole length. Although these ossifications are not developed from cartilage and have a very peculiar structure (they consist of a calcified fibro-cartilage with peculiar ossified strong fibres running straight through their whole thickness), it is clear enough that they exactly correspond to the above-mentioned plates and wedges of other Plagiostomes formed out of the coalesced crural cartilages.

From certain modes of transformation of the sheath of the chorda, combined with certain changes of the outer ossifying layer, the following types in the composition of the vertebral bodies may be established.

Type I.—*The vertebral body takes its origin entirely from the proper sheath of the chorda.*

A. *Sheath of the chorda thick.*

1st. Vertebral bodies soft (fibro-cartilaginous), incompletely separated from each other, and only distinguished by the interior septa of the chorda. *Hexanchus.*

2nd. Vertebral bodies partly cartilaginous, with annular ossifica-

tions of the form of short double cones. Ligamenta intervertebralia very strong. *Heptanchus* (anterior vertebra).

3rd. Vertebral bodies wholly cartilaginous, with thin osseous double cones of good length in the middle of the cartilaginous body. *Centrophorus.*

4th. Vertebral bodies well ossified, cylindrical and strong, formed inside by strong osseous double cones, and outside by alternating layers of cartilage and bone. *Squatina.*

B. *Sheath of the chorda thin.*

5th. Vertebral body a thin hollow osseous cylinder; chorda proper in its whole length cylindrical. *Leptocephalus, Helmichthys, Hyoprorus* (last vertebra).

6th. Vertebral bodies slightly constricted osseous double cones, with external longitudinal ridges. *Chauliodus, Stomias.*

Type II.—*The vertebral body is formed partly from the sheath of the chorda and partly from the outer ossifying layer.*

1st. Chordal vertebral body partly cartilaginous, with a stronger osseous double cone in its middle part. External part of the body formed by a thin layer of cartilage from the coalesced arches, with *two* lateral ossified plates. *Heptanchus* (posterior vertebræ).

2nd. The same with *four* external ossifications, whose ends coalesce with the internal double cone. *Acanthias, Scymnus.*

3rd. Chordal vertebral body nearly totally ossified, of the form of a strong double cone, with strong external longitudinal ridges. External part of the body a strong layer of cartilage with superficial ossifications continuous with those of the arches. *Raia, Torpedo.*

4th. Chordal vertebral body nearly wholly ossified, of the form of a thick double cone. External part of the body formed by cartilage, with four strong wedge-shaped ossifications uniting with the ends of the inner double cone. *Scyllium.*

5th. Chordal vertebral body a strong osseous double cone, partly with external ridges. External part of the body formed by four strong wedge-shaped ossifications, derived from the periosteal layer between the cartilaginous arches, which in some genera totally coalesce with the inner double cone, whilst in others this happens only at the ends of the latter. *Mustelus, Carcharias, Sphyrna, Galeus.*

Type III.—*The vertebral bodies are wholly developed from the external ossifying layer.*

1st. The vertebral bodies are developed from four cartilaginous parts, viz. the superior and inferior arches. Anterior vertebræ of the Raiidæ.

2nd. The vertebral bodies are developed only from two cartilaginous or osseous parts.

a. From the two neural arches, which in uniting do not enclose the chorda, which lies underneath them. *Cultripes provincialis*, J. Müller, *Rana paradoxa*, Dugès.

b. From two lateral plates of ossified connective tissue, which in uniting totally enclose the chorda. Acaudate Batrachia, according to my own observations.

c. From two lateral cartilages which enclose the chorda, and also develope the arches from themselves. Higher Vertebrata.

In terminating this Note, I take the liberty of adding that the only information heretofore existing on the subject to which it refers, is that contained in the very valuable memoirs by J. Müller* and Williamson†.

ZOOLOGICAL SOCIETY.

March 8, 1859.—John Gould Esq., F.R.S., V.P., in the Chair.

Description of a new Species of Elanus. By J. Gould, F.R.S.

This new species is one of the largest members of the genus, and is rendered conspicuous by the entire under surface being white, even the basal half of all the primaries being of this hue,—in which respect, and in its larger size, it materially differs from the *E. melanopterus*, the only bird with which it could be confounded.

Elanus hypoleucus, Gould.

Adult.—Face, space over the eye, ear-coverts, all the under surface of the body, under tail-coverts, under surface of the tail feathers, and the thighs, pure white; the under surface of the wing is also pure white; basal half of the under side of the first six primaries white, slightly speckled with grey, passing into blackish grey; on their apical halves this grey hue also pervades the under surface of the remaining primaries; crown of the head, back of the neck, back, and scapularies, deep grey; on the shoulders a large patch of black; secondaries and basal half of the primaries deep grey, passing into blackish grey at their tips; two centre tail feathers grey above, the next on each side grey on their outer margins, the rest white; cere and legs orange yellow; bill and nails black.

Total length, 14 inches; bill, $1\frac{1}{4}$; wing, $12\frac{1}{8}$; tail, $6\frac{3}{4}$; tarsi, $1\frac{5}{8}$.

Young.—At apparently about nine months old differs from the adult in having the crown lineated with reddish brown, and a crescent of white at the tip of the primaries, secondaries, scapularies, and wing-coverts.

Hab. Vicinity of Macassar, Celebes.

Remark.—The above description of the adult is taken from a fine example in the possession of J. H. Gurney, Esq., which, as well as the young bird in the possession of Mr. Gould, was collected by Mr. Wallace.

April 12, 1859.—Professor Busk, F.R.S., in the Chair.

Description of a Rare Entozoon from the Stomach of the Dugong. By W. Baird, M.D., F.L.S., &c.

In the Museum of the College of Surgeons there is a preparation of an *Ascaris* from the stomach of the Dugong. In dissecting this

* Vergleichende Anatomie der Myxinoiden.

† Phil. Trans. 1850.

animal, Professor Owen discovered several specimens of an intestinal worm, which he named *Ascaris halichoris*. The preparation was made in 1831, and the 'Catalogue of the Physiological Series of Comparative Anatomy' was published by the College in 1833. About the same period, but in a different part of the world, Rüppell found the same species of worm in the stomach of the same species of animal. He very briefly notices them in describing a Dugong which he found in the Red Sea, but merely mentions that these Entozoa "were found in a clustered glandular apparatus in the stomach, and were 5 inches long." His description of this Dugong was sent in a letter to Dr. Sömmering, and is dated from the Island of Dahalac on the Abyssinian coast of the Red Sea, in the month of January, 1832. This paper was published in the first volume of the 'Museum Senckenbergianum,' in 1834. In the 'Proceedings of the Zoological Society' in 1838, there is an elaborate paper by Professor Owen, descriptive of the principal viscera of the Dugong; and in this paper he again notices these worms, and there mentions that they were originally found in a remarkable glandular apparatus situated near the cardiac extremity of the stomach. In the article *Entozoa* in Todd's 'Cyclopædia of Anatomy and Physiology,' the Professor again alludes to them in reference to its peculiar digestive apparatus, showing the presence of a cæcum, which arises from the upper portion of the intestine. This organ he considers a kind of accessory to the digestive apparatus, and of rather a peculiar nature. "The second example," he says, "of an accessory digestive gland occurs in a species of *Ascaris* infesting the stomach of a Dugong: here a single elongated cæcum is developed from the intestine at the distance of half an inch from the mouth; and is continued upwards, lying by the side of the beginning of the intestine, with its blind extremity close to the mouth; from the position where the secretion of this cæcum enters the intestine, it may be regarded as representing a rudimental liver." The next mention we find of this worm is in the 'Mémoires de l'Académie Impériale de St. Pétersbourg.' In the 7th volume of the Mémoires (the 5th volume of the 'Sciences Naturelles'), Brandt has published a paper entitled 'Symbolæ Sirenologicæ,' illustrating the natural history of the *Rhytina borealis* or *Stelleri*, a specimen of a Cetacean allied to the Dugong, in which he mentions the fact that Steller had found a number of white worms in a gland attached to the stomach of that animal; and in a note to his paper he says, "they are similar to those found by Owen and Rüppell in the Dugong." Lastly, Diesing, in his valuable work, 'Systema Helminthium,' 1851, apparently not aware of Professor Owen having named this *Ascaris*, enumerates it, along with a number of others, amongst his list of doubtful species, or "Species inquirendæ," under the name of *Ascaris dugonis*—a name which of course cannot stand, as that of Professor Owen has the precedence of nearly twenty years. The species found in the *Rhytina* by Steller appears to have been six inches long, the same length as those observed by Rüppell in the Dugong; but as this latter animal was found in the Red Sea, whilst

the former was taken in Behring's Straits, they can scarcely be identical. The *Ascaris halichoris*, though named long ago, has never been fully described ; I now propose to fill up this blank.

Ascaris halichoris, Owen.

Caput nudum, epidermide stricte adnata ; os labiis rotundatis, porrectis ; corpus, in utroque sexu, extremitatibus magis attenuatis ; extremitate caudali brevi, subulata, nuda.

Long. feminæ, $3\frac{1}{4}$ unc. ; maris, $2\frac{1}{4}$ unc.

The body is of a whitish colour, thickest in the centre, gradually tapering to each extremity, and is strongly striated across ; in the female, apparently all its length ; in the male, till nearly about half an inch from its posterior extremity. This latter portion is smooth or slightly striated lengthways. In the female, the vagina is situated at about two-thirds of its length from the anterior extremity. The spicula of the male appear very short. The intestine, as described by Professor Owen, has a cæcum developed from it at the distance of about half an inch from the mouth, and is continued upwards, lying by its side, and terminating in a blind extremity near the mouth. The specimens, now in the British Museum, are shorter than those noticed by Rüppell.

May 10, 1859.—John Gould, Esq., V.P., in the Chair.

Description of a New Species of Diver (Colymbus). By George Robert Gray, Esq., F.L.S., etc.

Colymbus Adamsii, G. R. Gr.

Closely allied to *C. glacialis* ; but the head and collar round the neck shining bluish-black, except on the top of the head and neck, which have a slight green reflexion ; the rows of spots of the tertials and secondaries very much larger and more like those of *C. arcticus*, while the spots on the sides of the abdomen and upper tail-coverts are smaller than those of *C. glacialis*. This bird is easily distinguished from either of those species by its larger bill, by having the gonys more strongly developed, and by its bill being of a yellowish-white colour.

Length 31″ ; bill from gape 5″, from the base of culmen 3″ 9‴ ; wings 15″.

Hab. Russian America.

This fine species is named after the late Mr. Adams, Surgeon of H.M.S. Enterprise, commanded by Capt. Collinson, in the voyage made by him through Behring's Straits. Mr. Adams employed his pencil in producing beautiful drawings of the remarkable birds obtained during the voyage ; but after his return to this country, he undertook the appointment of surgeon to one of H. M. S. on the West African Station, where he soon fell a victim to the unhealthy climate.

On some New Species of Synallaxis. By Philip Lutley Sclater, M.A., F.L.S., Secretary to the Society.

1. Synallaxis pudica.

Murino-brunnea, alarum remigibus et cauda obscurioribus; pileo cum fronte et alarum tectricibus omnibus rufis: subtus cinerascens, ventre imo albicantiore, lateribus brunnescentibus: rostro superiore nigricante, inferiore plumbeo; pedibus validis, nigris; cauda elongata, rectricibus decem.

Long. tota 7·0, alæ 2·6, caudæ 4·0, tarsi 0·95.

Hab. In Nov. Granada int.

This species is allied to *Synallaxis fuliginosa*, and of the same form, but easily distinguishable by its red head. From *S. elegans* (also from New Granada) it differs in its earthy-brown tail and cinereous colour below. The single specimen in the British Museum is a "Bogota" skin. I have likewise an example in my own collection, received from MM. Verreaux of Paris.

2. Synallaxis stictothorax.

Murino-brunnea, uropygio rufescente; alis caudaque intus nigricanti-brunneis, extus rufo late limbatis; superciliis a fronte et lateribus cervicis albidis, nigro obsoletè punctatis: subtus alba, lateribus et ventre imo rufescentibus; pectore toto maculis triangularibus nigricantibus asperso: rostro nigro, basi alba, pedibus fuscis.

Long. tota 4·75, alæ 2·0, caudæ 2·25, tarsi 0·75.

Hab. In rep. Equator.

I first noticed a specimen of this *Synallaxis* in Sir William Jardine's collection. The British Museum contains an example transmitted from Guayaquil by Mr. Barclay. The species is not very like any other *Synallaxis* that I am acquainted with, and may be distinguished easily by the arrow-headed or triangular spots on the breast, which are partly continued up the sides of the neck, and of which there are also some faint indications on the superciliaries.

3. Synallaxis scutata.

Supra murino-brunnea; dorso toto, alis extus et cauda rufis; superciliis ante oculum albis, post oculum magis cinnamomeis; remigum parte interna nigricante: subtus alba, pectore cinnamomeo lavato, plaga distincta quadrilaterali in cervice antica nigra: rostro plumbeo, basi pallidiore; pedibus pallide brunneis.

Long. tota 5·75, alæ 2·25, caudæ 2·75, tarsi 0·8.

Hab. In Brasilia.

I have as yet only seen one specimen of this distinct species, which is in the British Museum.

May 24, 1859.—G. R. Waterhouse, Esq., V.P., in the Chair.

On the Development of Aurelia aurita in the Society's Aquaria. By E. W. H. Holdsworth, F.L.S.

Few persons can have paid any attention to marine aquaria without noticing in them the frequent occurrence of the little white

polype, commonly known as *Hydra tuba.* The ova producing them are doubtless introduced with the sea-water; and if the conditions are suitable for their development, the rock-work and sides of the tank are often studded with hundreds of their delicate transparent bells. The changes they undergo before assuming the adult form have been investigated by Sars, Siebold, and many other naturalists; and it is now well known that these little polypoid forms are only early states of *Aurelia aurita*—the medusa seen thronging our coasts in such countless thousands during the summer months. The perfect animal, however, is so rarely produced within the limits of an aquarium, that a recent case of its occurrence in one of the Society's tanks appears to me worthy of record. Since the establishment of the Fish-house in the Zoological Gardens, not a year has passed without the abundant production of the polypes in several of the tanks, and their transverse splitting and change to medusoids have been frequently observed; but no further development has taken place, and after a short period the young animals have gradually disappeared. In the present year, however, greater success has been attained; and this is perhaps partly due to the water in the tank having been kept at a nearly uniform temperature, from the absence of any severe cold during the early part of the season. The polypes made their usual appearance about the end of January; and after two or three weeks a considerable number of medusoids were detached, of which a few only have survived; but some of these now exhibit all the specific characters of the perfect Medusa, the largest specimen at the present time being 3 inches in breadth when dilated, and the others of various intermediate sizes. It is unnecessary to detail here the gradual changes undergone in the course of development to the perfect animal, as they have been fully and accurately described by several authors: I will only mention that an instance was observed of two medusoids having been thrown off together from the parent stock, and remaining united for more than a week: each gave evidence of independent existence; and their course through the water was marked by great irregularity, from the uncertain and sometimes opposite action of the two disks.

The water containing these Medusæ has remained for several months unchanged; but its purity has not been endangered by the presence of fish, or other animals requiring a large supply of oxygen.

Indications of the Existence of a Second Species of Emeu (Dromæus). By A. D. Bartlett.

The specimen of *Dromæus* now exhibited was obtained with others far in the interior of South Australia, several hundred miles from Port Philip.

It differs from *Dromæus Novæ-hollandiæ* in having the whole of the feathers of the body distinctly marked with narrow transverse bars of light grey and dark brownish black. The feathers of the back and sides of the bird are broader and longer and less silky in texture than those of the common species: that this is so, is quite evident to the touch. The upper part of the neck and head is nearly black;

and the feathers appear thicker than those on these parts in the common bird.

The specimen from which these remarks are taken was one of three examined by me, two of which were adult, and one a young bird about one-third grown. This young bird exhibited the transverse bars on its plumage as distinctly as the adult bird; at the same time the broad longitudinal stripes were clearly to be seen. Judging from the skins, I am inclined to consider this bird to be smaller than the common species. As I hope before long to obtain more information respecting these birds, together with other and more perfect specimens, I beg to propose provisionally the name of *Dromæus irroratus* for this supposed new species.

A Record of the Number of Days of Incubation of Birds which breed in the Society's Gardens. By Philip Lutley Sclater, M.A., F.L.S.

The subjoined table, furnished to me from the observations of our intelligent Assistant Head Keeper, Benjamin Misselbrook, gives the period of incubation of eighteen species of birds which ordinarily breed in our Gardens. The time of incubation appears to be as constant in each species of bird as the period of gestation in each species of mammal; and I think that every addition to our imperfect knowledge of this subject must be of interest to the naturalist, and worthy of record.

		Days.
1.	Emeu * (*Dromæus Novæ-hollandiæ*)	56
2.	American Rhea (*Rhea americana*)	35
3.	Impeyan Pheasant (*Lophophorus Impeyanus*)	28
4.	Cheer Pheasant (*Catreus Wallichii*)	28
5.	Purple Pheasant (*Gallophasis Horsfieldii*)	24
6.	White-crested Kaleege (*Gallophasis albocristatus*)	26
7.	Black-backed Kaleege (*Gallophasis melanonotus*)	24
8.	Californian Quail (*Callipepla californica*)	21
9.	Crowned Pigeon (*Goura coronata*)	28
10.	Crested Pigeon (*Ocyphaps lophotes*)	14
11.	Black-necked Swan (*Cygnus nigricollis*)	35
12.	Black Swan (*Cygnus atratus*)	35
13.	Cereopsis Goose (*Cereopsis Novæ-hollandiæ*)	35
14.	Sandwich-Island Goose (*Bernicla sandvicensis*)	31
15.	Ashy-headed Goose (*Chloëphaga poliocephala*)	30
16.	Ruddy Shieldrake (*Casarca rutila*)	30
17.	Summer Duck (*Aix sponsa*)	30
18.	Mandarin Duck (*Aix galericulata*)	30

June 28, 1859.—Dr. Gray, F.R.S., V.P., in the Chair.

Description of some new recent Entomostraca. By W. Baird, M.D., F.L.S., etc.

The *Entomostraca* now about to be described were taken from some freshwater pools at Nagpur, and placed in my hands by the

* The eggs of the Emeu and Rhea were hatched in the Society's incubator.

Rev. Mr. Hislop. It is interesting to find two species of *Cypris* in a recent state, that had been already described as fossil.

Estheria Hislopi, Baird.

Animal.—Head large, prolonged anteriorly into a beak of considerable size, which is rounded at the extremity, and toothed on its upper edge. The first three or four teeth are very distinct, they then become smaller and less distinct; they are very numerous. Eye large, compound. Superior antennæ or rami thick, rather short, composed of two branches, each of which consists of seven articulations only; each articulation, close to the joint, is armed with short spines, and the last two or three possess longer setæ. Antennules long, nearly half the length of superior antennæ, rather slender, composed of four joints, the last joint rather club-shaped; all destitute of setæ. Tail large, armed with seven or eight pairs of strong, slightly curved hooks; the first pair are long, serrated on the edges; the second pair, near the root, armed with about ten rather stout spines. Mandibles strong, fleshy.

Shell.—Carapace nearly orbicular; umbo prominent; margins quite round. Altogether the shell very closely resembles that of the genus *Artemis* or *Dosinia* amongst the Mollusca. Shell surrounded with six or seven concentric ridges; the surface between them, when magnified, is seen to be pitted or marked with very numerous, small, close-set dots or punctures. When dry, it is of a clear, polished, shining appearance.

Hab. Freshwater pools at Nagpur (*Rev. S. Hislop*). *Mus.* Brit.

Cypris subglobosa, Sow.

The shell is of a green colour; and the surface is strongly punctured, the pattern resembling the depressed punctures of a thimble. The anterior extremity is somewhat broader than the posterior, and when seen from the inside appears as it were double, the external edge of the carapace being produced beyond the true margin of the shell. The lateral portion of the carapace is very prominently swollen or gibbous. The dorsal margin is convex; the ventral is concave and sinuated.

Hab. Freshwater pools at Nagpur (*Rev. S. Hislop*). *Mus.* Brit.

This species appears to be identical with *C. subglobosa* of Sowerby, which was found by my old friend the late John Grant Malcolmson, Esq., in the district of the Sichel Hills, the geology of which he has described at length in the fifth volume of the Transactions of the Geological Society, 2nd series. It was described shortly by Mr. J. de C. Sowerby at the end of Malcolmson's paper, in these words:—"Subglobose, triangular, inflated; front concave; outer surface is punctured." It was found in grey chert, with a species of Unio (*U. deccanensis*), &c., and in indurated clay with *Gyrgonites, Paludinæ, Physæ,* and *Lymnæi.*

Cypris cylindrica, Sow.

The shell is of a green colour, somewhat mottled. It is cylindrical in shape; the anterior margin rounded; dorsal margin slightly con-

vex till it approaches the posterior extremity, when it suddenly slopes down, and is there bluntly pointed. The ventral margin is slightly sinuated in the centre. The valves are somewhat gibbous in their lateral portion. Internally, we see near the anterior margin a kind of shelf, which extends across that portion of the shell, and is hollow underneath it—exactly resembling the shelf we see in the shells of the genus *Crepidula*. The surface of the carapace is very minutely and slightly punctate. The edge of the ventral margin of the carapace, both inside and outside, appears thickened, which thickening, as seen on the inside of the shell, extends to the commencement of the dorsal margin at either extremity, and there the shell both internally and externally is strongly and regularly ridged.

Hab. Along with *C. subglobosa* in pools at Nagpur. *Mus.* Brit.

This species appears to me to be identical with *C. cylindrica*, described by Mr. Sowerby at the end of Mr. Malcolmson's paper "on the Geology of the Sichel Hills," mentioned above. It was found along with *C. subglobosa* in chert and indurated clay, along with *Unio deccanensis*, *Gyrgonites*, *Paludinæ*, *Physæ*, and *Lymnæi*. The chief difference consists in the recent shells being so slightly punctured on the surface as to appear nearly quite smooth. Mr. Sowerby thus describes it:—"Twice as wide as long, almost cylindrical; front very slightly concave; the outer surface, which is very rarely obtained, is punctured."

Cypris cylindrica, Sow., var. major, Baird.

The chief difference in this variety consists in its larger size, being about double in all its dimensions. The typical or smaller variety described above might at first sight appear to be merely the young; but an examination of a large series of that species shows them to be completely adult shells. The internal shelf, the thickening of the edges of the ventral margin, and the ridges on that margin are all indicative of a full-grown and adult shell.

The colour of the shell of this variety is almost exactly the same as the typical variety; the form is the same, but the shelf is rather larger, and there is some slight indication of a shelf at the posterior extremity also.

Hab. Along with the preceding (*Rev. S. Hislop*). *Mus.* Brit.

Cypris dentato-marginata, Baird.

Shell rounded-oval, swollen, smooth, of a light greenish colour, with a polished shining surface. Anterior extremity slightly narrower than posterior; dorsal margin somewhat convex; ventral margin nearly straight or slightly sinuated. Seen from the inside, the shell near each extremity is toothed, or marked with a series of small projections, like the teeth of a saw.

Hab. Pools at Nagpur (*Rev. S. Hislop*). *Mus.* Brit.

[P.S. Since the above was written, I have had my attention called by Mr. Hislop, through my friend Mr. T. Rupert Jones, to a paper by Mr. H. J. Carter, in the 'Geological Papers on Western India, 1857,' in which the author mentions some of the recent *Entomostraca* found in the freshwater deposits of Bombay, and of which he

gives an outline sketch in the Atlas accompanying the volume. These Mr. Carter considers as "the corresponding forms" of the fossil species mentioned by Mr. Malcolmson and described by Mr. Sowerby; but he does not attach any name to them.

In plate 9 of that Atlas, the species figured No. 19 is, without doubt, the same as what I consider to be the *Cypris cylindrica*, var. *major*, of this paper; and the species figured No. 18 is evidently identical with the *Cypris subglobosa*. The third species, figured No. 20, differs from any of those collected by Mr. Hislop.—W. B.]

On some New Freshwater Shells from Central Africa. By S. P. Woodward, F.G.S.

The four shells which form the subject of the present note were collected by Captain Speke in the great freshwater Lake Tanganyika in Central Africa.

The large bivalve belongs to the genus *Iridina*, Lamarck,—a group of river-mussels, of which there are nine reputed species, all belonging to the African Continent. This little group has been divided into several subgenera. That to which the new shell belongs is distinguished by its broad and deeply-wrinkled hinge-line, and is called *Pleiodon* by Conrad. The posterior slope of this shell is encrusted with tufa, as if there were limestone rocks in the vicinity of its habitat.

The small bivalve is a normal *Unio*, with finely sculptured valves.

The smaller univalve is concave beneath, and so much resembles a *Nerita* or *Calyptræa* that it would be taken for a sea-shell if its history were not well authenticated. It agrees essentially with *Lithoglyphus*,—a genus peculiar to the Danube, for the American shells referred to it are probably, or, I may say, certainly distinct. It agrees with the Danubian shells in the extreme obliquity of the aperture, and differs in the width of the umbilicus, which in the European species is nearly concealed by the callous columellar lip.

In the Upper Eocene Tertiaries of the Isle of Wight there are several estuary shells, forming the genus *Globulus*, Sow., whose affinities are uncertain, but which resemble *Lithoglyphus*.

Lake Tanganyika (situated in lat. 3° to 8° S. and long. 30° E.), which is several hundred miles in length and 30 to 40 in breadth, seems entirely disconnected with the region of the Danube; but the separation may not always have been so complete, for there is another great lake, Nyanza, to the northward of Tanganyika, which is believed by Speke to be the principal source of the Nile.

The other univalve is a *Melania*, of the subgenus *Melanella* (Swainson), similar in shape to *M. Hollandi* of S. Europe, and similar to several Eocene species of the Isle of Wight. Its colour, solidity, and tuberculated ribs give it much the appearance of a small marine whelk (*Nassa*); and it is found in more boisterous waters, on the shores of this great Inland Sea, than most of its congeners inhabit.

1. Iridina (Pleiodon) Spekii.

Shell oblong, ventricose, somewhat attenuated at each end; base slightly concave; epidermis chestnut-brown, deepening to black at

the margin; anterior slope obscurely radiated; hinge-line compressed in front and tuberculated, wider behind and deeply wrinkled.

Length $4\frac{3}{4}$, breadth 2, thickness $1\frac{3}{4}$ inches.

2. Unio Burtoni.

Shell small, oval, rather thin, somewhat pointed behind; umbones small, not eroded; pale olive, concentrically furrowed, and sculptured more or less with fine divaricating lines; anterior teeth narrow, not prominent; posterior teeth laminar; pedal scar confluent with anterior adductor.

Length 12, breadth $8\frac{1}{2}$, thickness $5\frac{1}{2}$ lines.

3. Lithoglyphus zonatus.

Shell orbicular, hemispherical; spire very small; aperture large, very oblique; umbilicus wide and shallow, with an open fissure in the young shell; lip continuous in front with the umbilical ridge; columella callous, ultimately covering the fissure; body-whirl flattened, pale olivaceous, with two brown bands, darker at the apex; lines of growth crossed by numerous oblique, interrupted striæ.

Diameter 5–6, height 3 lines.

4. Melania (Melanella) nassa.

Shell ovate, strong, pale brown, with (sometimes) two dark bands; spire shorter than the aperture; whirls flattened, ornamented with six brown spiral ridges crossed by a variable number of white, tuberculated, transverse ribs; base of body-whirl with eight tuberculated spiral ridges variegated with white and brown; aperture sinuated in front; outer lip simple; inner lip callous.

Length $8\frac{1}{2}$, breadth $5\frac{1}{2}$ lines.

P.S. July 27th.—In addition to the foregoing shells, several others were collected by Capt. Speke, when employed, under the command of Capt. Burton, in exploring Central Africa in the years 1856–9; these were deposited in the first instance with the Geographical Society, and are now transferred to the British Museum.

A specimen of *Ampullaria* (*Lanistes*) *sinistrorsa*, Lea, and odd valves of two species of *Unio*, both smooth and olive-coloured, were picked up in the Ugogo district, an elevated plateau in lat. 6° to 7° S., long. 34° to 35° E.

A large *Achatina*, most nearly related to *A. glutinosa*, Pfr., is the "common snail" of the region between Lake Tanganyika and the East coast. Fossil specimens were obtained in the Usagara district, at a place called Maroro, 3000 feet above the sea, overlooking the Lufiji River, where it intersects the coast range (lat. 7° to 8° S., long. 36° to 37° E.).

Another common land snail of the same district is the well-known "*Bulimus Caillaudi*, Pfr.," a shell more nearly related to *Achatina* than *Bulimus*.

Captain Speke also found a solitary example of *Bulimus ovoideus*, Brug., in a musjid on the island of Kiloa (lat. 9° S., long. 39° to 40° E.). This species is identical with *B. grandis*, Desh., from the island of Nosse Bé, Madagascar, and very closely allied to *B. liberianus*, Lea, from Guinea.

MISCELLANEOUS.

On the Hooks on the front Edge of the hinder Wings of certain Hymenoptera. Communicated by Dr. J. E. GRAY, F.R.S. &c.

A LADY correspondent (E. F. S.), fond of microscopic examination and entomology, has lately communicated to me some observations on the hooks of the hind wings of *Ophion* and some allied genera, and sent with them the specimens on which they were founded. They will probably be found interesting by some of the readers of the Annals:—

"Besides the hooks which are usually described as being on the hind wing just beyond the dark spot on the front margin, there are generally to be observed one or more hooks nearer to the base of the wings than the usual row of hooks. My specimen of *Paniscus glaucopterus* has none; but, on looking at it carefully, I find in each of the two wings, just where I should expect the hook, a small mark or scar, which, being exactly like a mark on one of the wings of another *Paniscus*, I believe to be the place where the hook was, and from which it has fallen, as the fellow-wing of that *Paniscus* has a hook exactly corresponding to this mark. I suspect this hook is easily rubbed off; but the mark of its insertion (you see I am taking this for granted) is, though faint, yet permanent. Might it not be worth while to mount some of the wings which seem to have no hooks in them, and see if this mark is there?

"In the specimen of *Hemiteles*, it cannot with propriety be called a hook, being perfectly straight.

"I have put up three of the fore wings, which show well the turning up of the margins for the reception of the hooks in the place opposite where these two sets of hooks are situated in the hinder wing.

"These sub-basal hooks have been observed in *Ophion*, *Pimpla varicornis*, and *P. turionellæ*, in species of the genera *Ephialtes*, *Paniscus* (*glaucopterus* and *inquinatus*), *Pimpla*, *Hemiteles*, and *Cryptus*.

"In *Ophion obscurus* there are two sub-basal hooks; in *Ophion combustus*, three.

"In *Paniscus* (No. 1) there is one hook, but with three or four strong, thick, short hairs on each side, more like it than the hairs in the line with them.

"My specimen of *Paniscus glaucopterus* has none; but there is the scar of the base of one, as before stated.

"The hinder wings of the few species I have observed show such different characters, that I will make a few observations on each of them.

"*Ophion obscurus* has two sub-basal and eight distal curved hooks. There are eight of the transparent dots of Dr. Hicks, in the pale central part of the inosculations of the nerves of the wing, and two smaller ones in a similar situation in the lower nervules.

"In *Ophion combustus* there are three sub-basal and seven distal

hooks, and three transparent dots in the upper and two in the lower inosculations of the nervules.

"In *Paniscus* (No. 1) there are no sub-basal (??) and seven slightly curved distal hooks, and two transparent dots in the upper inosculations of the nervules.

"*Paniscus glaucopterus* has one, or at least the very small scar of one sub-basal, and fifteen strong distal hooks, which are curved and furnished with an acutely recurved tip; there are numerous transparent dots in the elongate opake stigma, and three or four similar dots in the lower inosculation.

"*Paniscus inquinatus* has one distinct small sub-basal, and seven distal hooks.

"Besides the difference in the number of distal hooks in the species of this genus, there is considerable difference in the form of the upper nervules at the base of the wing. In *P. inquinatus*, the front nervule is forked at the base, the two forks being far apart; the upper one is short, with the sub-basal hook at its tip; and in *P. glaucopterus* this nervule is flattened out, and the separation into two forks is very indistinct and far from the base, and the latter has a series of short, rigid, spine-like hairs in front of the series of the upper edge of the wing.

"*Pimpla varicornis* has one sub-basal and nine distal hooks, which are slightly curved, and with a recurved apex. There is a black, rigid, nearly straight, elongate bristle in front of the series. There are two or three small transparent dots on the upper, and several also on the lower inosculations of the nervules.

"*Ephialtes*, sp., has one nearly straight sub-basal, and six arched distal hooks; their tips are not recurved.

"*Pimpla turionellæ* has one small, nearly straight sub-basal, and seven arched, distal, rather weak hooks.

"*Pimpla*, sp., has one small and six rather weak, slightly curved distal hooks.

"In *Hemiteles* the nervules are weak and rudimentary. There is only one very weak, indistinct sub-basal, and four very weak, slightly curved hooks in the distal series.

"*Cryptus* has also rudimentary nervules, a very small, weak basal, and six very slender, curved distal hooks.

"The hind wing of the genera *Ophion*, *Paniscus*, and *Pimpla*, and perhaps of the allied Hymenoptera, differs from the front one in the upper marginal nervules being forked at the base, the upper branch being short and extended to the edge of the wing; and it is on the apex of this branch that the sub-basal spine or spines are situated. The lower branch of the fork is extended to beyond the middle of the wing before it reaches the margin, and there it forms the stigma or subarticulated opake spot; and it is on the extension of this branch just beyond the stigma that the distal series of spines are situated. The edge of the wing between the two points of the fork is thin and membranaceous.

"The fore wings of these insects differ in the anterior nervules being simple, not forked, and forming the margin of the wing.

"In the genera *Cryptus* and *Hemiteles*, the anterior nervule of the hinder wing is simple, and the edge of the wing to the stigma is membranaceous, or nearly so, and the weak sub-basal hook is placed on the membrane.

"The hind wings of *Monodontomerus* have only a single longitudinal submarginal nervule, which is slightly dilated and nicked almost at the base. There are three well-developed distal hooks at the tip of the nervule, where it reaches the edge of the wing.

"The upper wings of the larger Ichneumons, as *Ophion combustus* and *Pimpla varicornis*, have a group of 'transparent dots' (Dr. Hicks) at the end of the first portion of the nervule near the stigma; while the lower wings have similar transparent dots at the dilated part of the nervules, produced by their inosculations. It may also be observed that there are certain parts where the nervules are more transparent than others, as if they were partially interrupted; and these interruptions occur in the same situation in almost all the wings of the genera I have examined."

Believing that all variations in organic structures entail a difference in the habits of the animals, I am induced to think that it is desirable that the genus *Paniscus*, which has such differently formed wings, should be divided into two groups: one, for which the name *Paniscus* may be retained, having many (about fifteen) hooks in the distal series, and a very small sub-basal one, and a thick margin to the base of the wing, of which *P. glaucopterus* may be considered the type; and the other, which have only six or seven hooks in the distal series, and a strong sub-basal hook, with thinner forked nervules to the base of the wing, may be called *Netelia*, with *Paniscus inquinatus* for its type.

I may observe at the same time, that attention to the number of spines appears to afford a ready means of distinguishing the species of this genus, which are very much alike in external appearance, and seem worthy of a more extended study.

Wesmael, Dufour, and other authors on the nerves of the wings of Hymenoptera, appear to have restricted their attention to the distribution of the nervules of the front wings; yet the hinder wings appear to offer as many characters. It is very desirable that these wings should be studied in connexion with the habits and economy of the insect, as affording characters for the separation of genera and species; for the result of the examination here given shows that the hooks and the pellucid dots in the wing afford good characters for the separation of very closely allied species, as easily described as the nervation of the upper wing itself, and quite as permanent.

Mr. Smith, to whom I have submitted the specimens, observes, with respect to the hooks which attach the posterior to the anterior wings of hymenopterous insects, &c., more particularly so in regard to those which are situated near the base of the wings, which appear to have been first observed by E. F. S., I have examined the wings of a few species in different families, and, as might be expected, with

very interesting results. I should observe that the hooks situated near the base of the wings had not previously attracted my notice, nor do I find any account of them in any of the works, such as those of Dufour or Wesmael, that I have consulted. It is well known that amongst the Hymenoptera are to be found groups which differ greatly in their power of flight: perhaps no order presents greater variation; every degree of difference is to be found between the rapid *Xylocopæ* and the lumbering and apparently helpless attempts at flight observable in sawflies, belonging to the genus *Dasytheus*. It will be obvious to every one that insects of such rapid flight as *Xylocopa* would require a stronger and more secure fastening or attachment of the wings than such insects as *Dasytheus*, which are amongst the weakest-, worst-flying insects in the entire order; and such is apparently the case. The very slight examination which I have been able to make gives the following results:—In *Xylocopa latipe s*I detect 38 hooks; in species of *Dasytheus*, 7–8 and 10; in the Ichneumonidæ the numbers are usually (apparently small) 8–10, 12, &c.; but as yet I have not had an opportunity of paying sufficient attention to this very interesting subject."

The Fabricius Sea Bull-Head (Acanthocottus Grœnlandicus). By Sir John Richardson, M.D.

In the third edition of Yarrell's 'British Fishes,' recently published, mention is made of the discovery, in Dingle Harbour, of an example of this fish. A second specimen was taken, two years ago, in the basin of the South Esk, at Montrose, from a salmon-net, by William Beattie, Esq. It may therefore be considered to be more than an accidental visitant to our coast.

Uriëchis microlepidotus.

To the Editors of the Annals and Magazine of Natural History.

Catton Hall, Norwich, March 14, 1860.

Gentlemen,—I request permission to correct a slight error in the account of the African snake (*Uriëchis microlepidotus*) recently presented by me to the British Museum, and described by Dr. A. Günther in your last Number.

The snake was not received by me from Algoa Bay, as stated in the above article, but from D'Urban, Port Natal, having been sent to me by Mr. Thomas Ayres, a very intelligent naturalist of that place, on whose farm the snake was ploughed up, together with the eggs which were sent with it.

I am, Gentlemen, yours, &c.,

John Henry Gurney.

On a Malformation in Echinus Flemingii, *Ball.* By Thos. Howard Stewart, Esq.

To the Editors of the Annals of Natural History.

Gentlemen,—Having lately received from the Devonshire coast a specimen of that beautiful British Echinoderm *Echinus Flemingii*, which possesses a curious malformation, I have thought it worth while to place it on record.

The ant-ambulacral ring of plates surrounding the anus is composed in the Cidariadæ and Echiniadæ of ten plates—five genital and five intergenital; the latter are perforated with a small orifice, in which the aquiferous canal terminates; the former have each a single large foramen communicating with the genital tube for the exit of the ova or spermatic fluid, as the case may be.

But, in the specimen I am now alluding to, that part of the genital plate where the single orifice is usually situated is raised into a papilla, and surrounded with five orifices, with the exception of that on the madreporic plate, which has only three.

Unfortunately the animal was eviscerated before this curious malformation was observed, so that the state of the ducts cannot be further investigated.

The remainder of the corona is somewhat slightly malformed; the anal orifice is about a quarter of an inch out of its normal position, and there is a considerable depression in the corona all round at about an inch from the ant-ambulacral ring. The specimen was obtained from about 40 fathoms depth, in the English Channel, off the Devonshire coast.

I remain, Gentlemen,
Yours, &c.,
Thos. Howard Stewart.

Royal Coll. of Surgeons,
March 15, 1860.

On the Sclerogenous Granules of the Berry of Arbutus Unedo. By George Gulliver, F.R.S.

I know not whether these granules have ever been described, either in the fruit of the Strawberry-tree or in that of any other heathwort, and am induced to notice them in the hope that botanists, who may have the opportunity, will observe whether they exist in any allied species. Should the granules be regularly present in the fruit, as I believe, and prove peculiar to this interesting tree, they will afford for it a new, very simple, plain, and durable distinctive character.

The granules are very dense and hard, rounded, of a whitish colour when cleaned, scarcely as big as poppy-seed, and are scattered throughout the pulp of the fruit, within the cells of which they seem to originate. But, though so much smaller than the seeds of the *Arbutus*, the granules greatly exceed the seeds of the same berry in number and weight.

The structure of the granules is the same as that of the gritty tissue of the Pear, described and figured by Professor Quekett (Lec-

tures on Histology, vol. i. fig. 41, 8vo, Lond. 1852), as he remarked to me when we examined them under a magnifying power of about 350 diameters; but the canaliculi of the corpuscles are not quite so distinct in the *Arbutus* as in the Pear.

As to their chemical composition, Dr. Davy kindly examined them at my request, and reports that "they consist chiefly of vegetable matter, and contain only a very small proportion of lime, with a trace of phosphate of lime."

Abstract of a Lecture by Prof. T. H. Huxley, F.R.S., *on Species and Races, and their Origin, delivered before the Members of the Royal Institution, on the Evening of Friday, February* 10, 1860.

The speaker opened his discourse by stating that its object was to place the fundamental propositions of Mr. Darwin's work 'On the Origin of Species by Natural Selection' in a clear light, and to consider whether, as the question at present stands, the evidence adduced in their favour is, or is not, conclusive.

After some preliminary remarks, in the course of which the speaker expressed his obligations for the liberality with which Mr. Darwin had allowed him to have access to a large portion of the MSS. of his forthcoming work, the phenomena of species in general were considered—the Horse being taken as an example of such species. The distinctions between this and other closely allied species, such as the Asses and Zebras, were considered, and they were sbown to be of two kinds, structural or morphological, and functional or physiological. Under the former head were ranged the callosities on the inner side of the fore and hind limbs of the Horse—its bushy tail, its peculiar larynx, its short ears, and broad hoofs; under the latter head, the fact that the offspring of the horse with any of the allied species is a hybrid, incapable of propagation with another mule, was particularly mentioned.

Leaving open the question whether the physiological distinction just mentioned is, or is not, a universal character of species, it is indubitable that it obtains between many species, and therefore has to be accounted for by any theory of their origin.

The species *Equus caballus,* thus separated from all others, is the centre round which a number of other remarkable phenomena are grouped. It is intimately allied in structure with three other members of the existing creation, the Hyrax, the Tapir, and the Rhinoceros; and less strait, though still definite, bonds of union connect it with every living thing. Going back in time, the Horse can be traced into the Pliocene formation, and perhaps it existed earlier still; but in the newer Miocene of Germany it is replaced by the *Hippotherium,* an animal very like a true *Equus,* but having the two rudimental toes in each foot developed, though small. Further back in time, in the Eocene rocks, neither *Equus* nor *Hippotherium* have been met with, nor *Rhinoceros, Tapirus,* nor *Hyrax*; but, instead of them, a singular animal the *Palæotherium,* which exhibits certain points of resemblance with each of the four existing genera, is found.

The speaker pointed out that these resemblances did not justify us in considering the *Palæotherium* as a more generalized type, any more than the resemblance of a father to his four sons justifies us in considering him as of a more generalized type than theirs.

The geographical distribution of the *Equidæ* was next considered; and the anomalies and difficulties it offers were pointed out; and lastly, the variations which horses offer in their feral and their domesticated condition were discussed.

The questions thus shown to be connected with the species Horse are offered by all species whatever; and the next point of the discourse was the consideration of the general character of the problem of the origin of species of which they form a part, and the necessary conditions of its solution.

So far as the logic of the matter goes, it was proved that this problem is of exactly the same character as multitudes of other physical problems, such as the origin of glaciers, or the origin of strata of marble; and a complete solution of it involves—1. The experimental determination of the conditions under which bodies having the characters of species are producible. 2. The proof that such conditions are actually operative in nature.

Any doctrine of the origin of species which satisfies these requirements must be regarded as a true theory of species; while any which does not, is, so far, defective, and must be regarded only as a hypothesis whose value is greater or less, according to its approximation to this standard.

It is Mr. Darwin's peculiar merit to have apprehended these logical necessities, and to have endeavoured to comply with them. The pigeons called Pouters, Tumblers, Fantails, &c., which the audience had an opportunity of examining, are, in his view, the result of so many long-continued experiments on the manufacture of species, and he considers that causes essentially similar to those which have given rise to these birds are operative in nature now, and have in past times been the agents in producing all the species we know. If neither of these positions can be upset, Mr. Darwin's must be regarded as a true theory of species, as well based as any other physical theory; they require, therefore, the most careful and searching criticism.

After pointing out the remarkable differences in structure and habit between the Carrier, Pouter, Fantail, Tumbler, and the wild *Columba livia*, the speaker expressed his entire agreement with Mr. Darwin's conclusion, that all the former domesticated breeds had arisen from the last-named wild stock; and on the following grounds—1. That all interbreed freely with one another. 2. That none of the domesticated breeds presents the slightest approximation to any wild species but *C. livia*, whose characteristic markings are at times exhibited by all. 3. That the known habits of the Indian variety of the Rock Pigeon (*C. intermedia*) render its domestication easily intelligible. 4. That existing varieties connect the extremest modifications of the domestic breeds by insensible links with *C. livia*. 5. That there is historical evidence of the divergence of existing breeds, *e.g.* the Tumbler, from forms less unlike *C. livia*.

The speaker then analyzed the process of selection by which the domesticated breeds had been produced from the wild Rock Pigeon, and he showed its possibility to depend upon laws which hold good for all species,—viz. 1. That every species tends to vary. 2. That variations are capable of hereditary transmission. The second law is well understood; but the speaker adverted to the miscomprehension which appears to prevail regarding the first, and showed that the variation of a species is by no means an adaptation to conditions in the sense in which that phrase is commonly used. Pigeon fanciers, in fact, subject their pigeons to a complete uniformity of conditions; but while the similarly used feet, legs, skull, sacral vertebræ, tail-feathers, oil-gland, and crop undergo the most extraordinary modifications, on the other hand, the wings, whose use is hardly ever permitted to the choice breeds, have hitherto shown no sign of diminution. Man has not as yet been able to determine a variation; he only favours those which arise spontaneously, *i.e.* are determined by unknown conditions.

It must be admitted that, by selection, a species may be made to give rise experimentally to excessively different modifications; and the next question is, do causes adequate to exert selection exist in nature? On this point, the speaker referred his audience to Mr. Darwin's chapter on the struggle for existence, as affording ample satisfactory proof that such adequate natural causes do exist.

There can be no doubt that just as man cherishes the varieties he wishes to preserve, and destroys those he does not care about, so Nature (even if we consider the physical world as a mere mechanism) must tend to cherish those varieties which are better fitted to work harmoniously with the conditions she offers, and to destroy the rest.

There seems to be no doubt, then, that modifications equivalent in extent to the four breeds of pigeons might be developed from a species by natural causes; and therefore, if it can be shown that these breeds have all the characters which are ever found in species, Mr. Darwin's case would be complete. Unfortunately, however, there is as yet no *proof* that, by selection, modifications having the physiological character of species (*i.e.* whose offspring are incapable of propagation, *inter se*) have ever been produced from a common stock.

No doubt the numerous indirect arguments brought forward by Mr. Darwin to weaken the force of this objection are of great weight; no doubt it cannot be proved that all species give rise to hybrids infertile *inter se*; no doubt (so far as the speaker's private conviction went) a well-conducted series of experiments very probably would yield us derivatives from a common stock, whose offspring should be infertile *inter se*; but we must deal with facts as they stand, and at present it must be admitted that Mr. Darwin's theory does not account for all the phenomena exhibited by species: and, so far, falls short of being a perfectly satisfactory theory.

Nevertheless, the speaker expressed his sense of the extremely high value to be attached to Mr. Darwin's hypothesis, and avowed his own conviction that the following it out must ultimately lead us to the detection of the laws which have governed the origin of species.

Mr. Darwin's Theory of Development. By J. O. Westwood.

The observation relative to the Swedish Turnip to which I alluded in my note on this subject occurs in page 997 of last year's 'Gardeners' Chronicle,' and is to the effect that the discussion at the Central Farmers' Club, on Monday, 5th December, turned upon the need of finding a substitute for that vegetable, which was rapidly deteriorating in the hands of the farmer in spite of the best efforts both of agriculturists and scientific men. With reference to Mr. Darwin's note on this subject (*ante*, p. 49), I apprehend, in the absence of details, that this is not a question as to the permanence of a cross-bred production, but one of reversion, in which it is found impossible to maintain the status of a species which has been ennobled (to use a term which has lately been adopted for these modified high-bred specimens, and which we may expect to see applied with equal propriety to the fat pigs exhibited at Christmas which can neither see nor walk). These latter, like the Swedish Turnips, have been brought by man out of their natural condition; they are, in fact, monsters, and Nature will get rid of them and revert to the old true type of the species. Of varieties of distinct species produced in a state of nature, even when carried beyond individual variations (which have been termed sub-species or geographical varieties), I believe also that Nature constantly endeavours to get rid of them in the same manner, although a persistence of the predisposing causes may, even for a long time, render the variety apparently permanent. I cited the case of the Ibis as an instance showing that a species has remained permanent during the whole historic period; and I think that we are thereby authorized in supposing that if that bird were reduced to the condition of a single pair (as its first creation), the progeny of that pair would in 3000 more years be as true to the character of the species as the present individuals are. As to the hive-bee, I intended to allude more especially to the case where a single hive might become the founder of an extensive apiary far removed from any other, the different hives being of course tenanted by the progeny of the first stock. Extensive bee-keepers do not find it necessary to import hives from a distance to keep up their establishments; and thus the species would keep true, immaterial whether the queens paired with their own subjects or with those of adjacent hives, all having descended from the same single stock-hive. The Egyptian records furnish us with another instance which we find to be in complete opposition to Mr. Darwin's theory. We there see the African ostrich, one of the most extreme types of the class of birds, faithfully represented. According to Mr. Darwin's theory, it is mainly for the welfare both of the species and individual that modifications take place and new forms are developed. Now, there can be no doubt that it would have been beneficial to this bird, both specifically and individually, if its coveted plumes could have been shortened and its wings lengthened, so as the better to escape from its pursuers. Moreover, as every one who saw the tame ostriches in the circus at Kensington during the Great Exhibition of 1851 will recollect, when driven to their fullest speed

they stretch out their short stumps of wings in order to assist in their attempts to escape. But all their efforts to acquire by such means the additional power of flight have been unavailing, and the type of the species remains as it was in this respect 3000 years ago. And in the case of other analogous species of birds, such as the Dinornis and the Dodo, we know that the actual destruction of the species has taken place, whilst that of the Kivi of New Zealand is equally certain in a very short time. I purposely avoid referring to geological evidences, believing that—1st, if the permanence of a species can be proved for such a length of time as 3000 years; 2ndly, if it be admitted that varieties exhibit a tendency to revert to the original type; and 3rdly, if cases can be shown in which modifications beneficial to a species have not taken place in wild animals, even when the creature has made efforts in that direction, we are in each of these cases furnished with an answer to Mr. Darwin's theory. As regards the second of these points, it seems inevitable that a theory which supposes the principle of development to be inherent in the works of the creation cannot be maintained if it be admitted that the antagonistic principle of reversion be also inherent in individuals. Mr. Darwin builds his theory that species are only intensified varieties, and that generic groups are only intensified species, mainly on the modifications which man has effected in domestic animals. For his theory, however, to work, it is necessary to suppose that the modified individuals possess such powers of discrimination as well as of exclusiveness as not to allow of their intermingling with their less favoured brethren, whereby they would keep their improvements to themselves. Thus, supposing the large and small common white Cabbage-butterflies to be modifications of one species, we must allow to them (as they never pair together, although frequenting the same garden and feeding on the same cabbage) a power of selection for breeding purposes which the improved breeds of domestic animals do not possess. The terrier and spaniel, or the pouter and tumbler pigeons will, under similar circumstances, breed together, although they apparently differ much more from each other than these two species of butterflies. It will at once be seen that the idea of such a power of selection becomes more and more untenable the nearer we ascend to the supposed origin of the modification.—*Gardeners' Chronicle*, Feb. 11, 1860.

Mr. Darwin on the Origin of Species. By W. H. Harvey, M.D.

In a recent number of the 'Gardeners' Chronicle' you figure a monstrous many-headed Cauliflower; and, in making some editorial remarks upon it, you suggest that it possibly throws some light upon the way in which species, according to Mr. Darwin's theory, originate in Nature. I am not quite sure that, as respects this particular Cauliflower, Mr. Darwin would agree with you, for it hardly comes within his principle, which denies to natural selection any power to act, unless the variation acted on be "favourable to the variety," in battling with its neighbours in "the struggle for life." Now, though the many heads may be very advantageous to the cook or the market gardener, it is doubtful whether, in a crowded society,

they would help a plant that had them in pushing itself forward toward the light. For, in a struggle, the lateral heads would become etiolated and abortive by the close contact of neighbouring plants, and the terminal head would alone have a chance of pushing forward and forming seed. Meantime the new variety would be spending its strength (like a Protectionist) in favouring a non-paying "manufactory." Clearly, therefore, the old, one-headed cauliflowers, unburdened with unprofitable speculations and concentrating all their energies on one result, would stand the better chance of turning their "crown into a pound." But, be this as it may, I wish now to call the attention of your readers to another monster, which, by a curious coincidence, appeared at Kew about the same time that Mr. Darwin's book appeared in Albemarle Street, and which, if I interpret it aright, speaks much more forcibly against the truth of Mr. Darwin's hypothesis than your cauliflower, on the most favourable interpretation, says in its favour. I allude to a monstrosity in *Begonia frigida*, figured in the 'Botanical Magazine,' t. 5160. fig. 4, and thus described by Sir William Hooker:—"Our artist, Mr. Fitch, while making the drawing, detected a curious morphological structure in the fact of one of the flowers having an *inferior* perianth of four very unequal sepals (such as are indicative of a male flower); and above their point of insertion are four stamens (apparently perfect), alternating with four *superior*, free, ovate ovaries, each with a short style, and two downy linear stigmas. It is to be regretted that no section was made of these ovaries, which, from situation and in form, so little resemble the three-celled inferior fruit of *Begonia*." To this account I may add that Dr. Hooker assures me that the ovules appeared to be normal, such as might have been fertilized. Let us suppose that they were perfect, and had been allowed to seed; every gardener would anticipate, I presume, that some of the progeny at least, if not all, would have borne similar flowers. Now, had this occurred in a state of nature, and had a botanist collected a plant with such flowers, he would not only have placed it in a distinct genus from *Begonia*, but would probably have considered it as the type of a new natural order. Can it be possible, then, that genera and even natural orders spring up like mushrooms in this sudden manner? According to Mr. Darwin's hypothesis, the thing is impossible; for it would have required hundreds, perhaps thousands of successive generations to have enabled "natural selection" to convert an inferior ovary and unisexual flowers into a superior ovary and bisexual flowers. If there be one thing more frequently iterated than another in Mr. Darwin's book, it is this: that "it is fatal to my theory" if changes be not slowly progressive, by the accumulation of small increments from generation to generation; increments which, at first, may be only obvious to a breeder, but which, "bred up to" continuously, are sufficient, through "natural selection" alone (as we are told p. 186), to change the eye-speck of a Medusa into the human eye (if not to transform a slave-making ant into a Southern States-man). If time be only long enough, and generations and divarications of form many enough, according to the theory, not only such things may be done, but they have been done!

But a sudden change, like that hinted at by our Begonia, was not contemplated by Mr. Darwin's hypothesis; and if such should ever be established; if seeds should ever be raised from such a flower, and should breed true, then the theory would receive a serious damage, and a few such cases would overthrow it altogether. For, says Mr. Darwin, at page 206, "on the theory of natural selection we can clearly understand the full meaning of that old canon in natural history, 'Natura non facit saltum.' This canon, if we look only to the present inhabitants of the world, is not strictly correct; but if we include all those of past times, it must by my theory be strictly true." It might be easily shown, by quoting other passages, that the theory, strictly taken, denies not only a "saltus" but a "gradus," and proceeds by a sliding-scale. But let us confine ourselves to the "saltus." Is it not a "saltus" for a plant, at one bound, to change an inferior ovary and unisexual flowers to a superior ovary and bisexual? Would not such a fact, if fairly established in the vegetable world, be almost as wonderful as if a rhinoceros were born of an elephant? And are we quite sure that such a fact has not occurred in Nature? I merely throw out as a hint—not as asserting a truth, or even a probability, but merely as a hint, hypothetically put—that there are two natural orders of plants which have so many indications of common affinity that they were placed near together by Mr. Brown, but which differ from each other nearly by the very same characters as those by which our monstrous Begonia differs from its normal parent. The orders I allude to are Aristolochiaceæ and Nepenthaceæ. Aristolochiaceæ, like *Begonia*, has an inferior ovary of 3–6 carpels; Nepenthaceæ, like our monster, a superior ovary of 4 carpels. On theoretic principles, it is probable that Nepenthaceæ is the newest type; for it is not, as yet, generically diversified, its flowers are 4-merous, its embryo more fully organized, and its geographical range more limited; and, as we are supposing, we may further guess that if *Nepenthes* were born "per saltum" from an Aristolochioid, it was some such genus as *Trichopodium* or *Asiphonia* that performed the part of cuckoo-parent. I use the term "cuckoo-parent" advisedly, for I should consider such an origin to be as true and as miraculous a creation (not "manufacture") of a new type as if it had pleased the Divine Creator to call up, without seed, from the dust of the ground, a new organism, by the power of his omnipotent word.—*Gardener's Chronicle*, Feb. 25, 1860.

The Monstrous Begonia frigida *at Kew, in relation to Mr. Darwin's Theory of Natural Selection.* By J. D. Hooker, M.D.

Your ingenious correspondent, Dr. Harvey of Dublin, has noticed this remarkable plant in your last Number, and described the singular modifications of the floral organs as presenting a most decided "saltus." He proceeds to speculate on the importance of this case as affecting Mr. Darwin's theory, and, by what appears to me to be reasoning "per saltum," he arrives at the conclusion that "a few such cases would overthrow Mr. Darwin's hypothesis altogether!" Now I venture, on the contrary, to think that the "saltus" of this *Begonia frigida* has not the importance which Dr. Harvey imagines; and

that, supposing (as he conceives possible) the seeds of the most aberrant flower to produce plants with similar flowers, the case would not even then militate against Mr. Darwin's theory, but the contrary. In the first place, let us attentively study this Begonia itself; its flowers are, like those of its congeners, normally unisexual, and produced in great abundance, both males and females, in the same fascicles all over the plant. The female flowers are perfectly constant in all their characters, except that they vary in having 3–4 cells and stigmas to the ovary and as many wings (which is not without precedent in the genus). The males have usually 6–15 stamens in the very centre of the flower, with no trace of stigmas or ovary; and not 10 per cent. present any deviation from this condition. Of those that do deviate, most have 3–5 deformed stamens or rudimentary ovaries in the axis of the flower, and proportionally fewer perfect stamens; and between the normal male flower and the very rare instances of a regular flower with four superior carpels (more or less united in the axis) and as many hypogynous stamens opposite the sepals, we find flowers with every conceivable modification in number, regularity, and perfection of stamens and carpels. Lastly, the abnormal carpels always bear very few ovules indeed, as compared with the normal ones. Now, it is very startling to be asked "is it not a 'saltus' for a plant at one bound to change an inferior ovary and unisexual flowers into a superior ovary and bisexual flowers?" but there is another way of putting the question, which is more accurate, however flat it may fall on the ear: viz., "is it a 'saltus' that a Begonia should produce male flowers, in a very few of which the central stamens are deformed, and in others are converted into more or less rudimentary or even perfect free or connate pistils?" So much for the plant. My friend proceeds to say that "according to Darwin's hypothesis it would have required hundreds, perhaps thousands, of successive generations to have enabled natural selection to convert an inferior ovary and unisexual flowers into a superior ovary and bisexual flowers." Mr. Darwin will, I think, demur to this, and still more to the rash assumption that, supposing any seeds of the hermaphrodite flowers of the Begonia should produce plants bearing none but hermaphrodite flowers, the latter would constitute even a new species amongst botanists, who would infallibly detect the true nature of the sport in this (as they have in similar cases), as soon as the normal state of the plant were known. In the first place, we do not know how many generations have elapsed since *Begonia frigida* commenced to bear any hermaphrodite flowers, nor how many generations may elapse before all traces of unisexual flowers will be obliterated in the progeny of a plant now bearing only about 5 per cent. of bisexual flowers; and it is to be borne in mind not only that these ovaries are incomparably the least prolific, but further, that, from being hermaphrodite, they are likely to be self-fertilized, and, according to Mr. Darwin's well-established observations, will hence give birth to a less numerous and less vigorous progeny. Nor must it be forgotten that this may be the lingering type of a by-gone phase of Begoniaceæ when all had superior ovaries; for that it may be the

last of an old race is as conceivable as that it is the first of a new one. An attentive study of the *Begonia* and a careful perusal of Darwin's book will, I am sure, convince your readers that this variation is a fact after that author's own heart. The fact of a metamorphosis so simple and common as that of stamens into carpels, suggesting to a first-rate botanist a new view of the affinity of the plant in which it occurs, is a very frequent one, and shows the imperfection of our knowledge and systems, not the magnitude or importance in the abstract of the changes that affect them. Instead of this being a case which (according to Dr. Harvey) "was not contemplated by Mr. Darwin's hypothesis," it is one of a class which he had specially in view; it is a beautiful illustration of the truth and wisdom of his chapter on classification, in which he shows how false are often the standards by which we estimate the value of characters; how loaded by preconceived ideas is the balance in which we weigh them; how prone, in short, we are to assume that a change is in itself fundamental, because it shakes our systems to the foundation. The differences between the extreme forms of the *Begonia* flowers are in no way comparable to those between "an elephant and a rhinoceros;" nor do they lead us to imagine that the latter could ever be the progeny of the former. According to Darwin's hypothesis, the change from species to species must be slow, and is effected by the accumulation of small differences; this Begonia, assuming it to be the herald of a new type of Begoniaceæ, is a good instance of how slow and partial such a change is at the commencement; for it is confined to one set of organs in a very few flowers of one sex only, is conducted with the least possible disturbance of the functions of the plant, and there are prodigious odds against its ultimate success. We cannot indeed conceive the new form replacing the old till after the lapse of many generations, and a long course of that operation of natural selection which my friend thinks his forthcoming new type of Begoniaceæ has already dispensed with. Lastly, Dr. Harvey makes a most ingenious use of the abnormal flowers of the *Begonia* in seeking the affinity of the curious order to which it belongs; and assumes that it tends to place Begoniaceæ in the same alliance with Aristolochieæ and others, because it too includes genera with a superior and an inferior fruit; but amongst the many orders that share this peculiarity of the *Begonia* there is one much nearer to the position assigned to it (by Lindley first and by common consent since), and that is the alliance of Saxifrages: in these, and often in the same genus, we have superior and inferior ovaries *, free and connate carpels, with several modifications of placentation, epigynous, perigynous, and hypogynous stamens, the peculiar ovules of *Begonia*, its remarkable seeds, and its reticulated testa. Finally, to the same group also belongs *Sempervivum*, which offers another most curious instance of the conversion of stamens into carpels.—*Gardeners' Chronicle*, Feb. 25, 1860.

* I need hardly remind the botanical reader that the conversion of staminiferous into pistilliferous flowers in unisexual trees is not uncommon, and that free superior carpels occur in species whose ovaries are normally inferior.

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[THIRD SERIES.]

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XXXVII.—*On the Genus* Notopterophorus *of Costa*. By Rudolph Leuckart*.

[With a Plate.]

During my residence in Nice in 1853, I several times found amongst other parasites†, in the cloacal space and respiratory cavity of *Phallusia mamillaris*, a parasitic Crustacean of very peculiar appearance, such as I had never previously met with. I regarded it as new, and gave it the name of *Calathopterus*, on account of the basket-like structure of the wing-like processes attached to the back of the thoracic segments; and, in compliment to my honoured friend Verany, who took the greatest interest in this Crustacean, I called it *C. Veranyi*.

On my return journey, I was enabled, at Turin, by the kindness of Professor de' Filippi, to inspect Costa's 'Fauna del Regno di Napoli,' a work very little known in Germany; and here, after the first few leaves, I met with plate 2 of the Entomostraca, containing a figure of my parasite, or of a very similar form. The text and explanation of the plates were wanting, at least for the plate in question; I therefore remained in a state of uncertainty as to the name of my animal.

This uncertainty has only been partially removed since. I succeeded, however, in discovering a second copy of Costa's work in the library of Senator von Heyden of Frankfort; but in this also the text and explanation of the plates were wanting.

* Translated from Wiegmann's Archiv, 1859, p. 241, by W. S. Dallas, F.L.S.

† Especially *Amphipoda* and *Nemertina*. Once, also, a small Cecropiform parasite ($\frac{3}{4}$ line in length), with long tufts of bristles between the legs, was met with. The margins of the thoracic segments were elongated, especially that of the last segment, which formed a regular roof destined for the reception of the cylindrical abdomen and the two rose-coloured egg-sacs.

The catalogue belonging to it, however, indicated that the following species were described under the order *Pœcilopodi*:—*Edwardsia fulgens*, Costa (*Sapphirina*, Auct.); *Cecrops Latreillei*; *Gunenotophorus globularis*, n.; *Notopterophorus elongatus*, n.; and *N. elatus*, n. Our animal consequently belonged to one of the two last-named genera; and, indeed, judging from the etymology (although the derivation of *Gunenotophorus* * is quite unintelligible to me), to *Notopterophorus*. As, however, Costa describes two species of this genus, it remains doubtful which name belongs to the figure referred to. Plate 2 contains, besides the animal in question (fig. 4), two other allied Crustaceans (figs. 1 & 2), possibly, however, only different states of the same species, which, instead of the wing-like processes on the back of the thorax, possess a hump-like inflation, apparently filled with young. The name *Notopterophorus* would hardly apply to these, so that the two figures are perhaps to be referred to the problematical *Gunenotophorus*. (I did not see the third plate, which might possibly give us some information on this point; at least, I have no recollection of it.)

As, however, I have already remarked that Costa's figure differs in many respects, especially as regards the dorsal wings, from my parasite, I may justly describe it here as *Notopterophorus Veranyi*.

I am not, however, the only person who has observed this Crustacean. On mentioning my parasite to Dr. Krohn, at the time of the meeting of naturalists at Bonn, I learnt that this distinguished student of the fauna of our coasts had likewise met with it, and indeed not unfrequently, in various species of *Phallusia* (at Naples). Dr. Krohn was so kind as to place at my disposal the drawing which he had made, together with the notes connected with it. This drawing is reproduced in Plate XVI. B. fig. 2, and the notes, wherever they differ from, or serve to complete my own, are incorporated in my description, with the name of the observer.

Our Crustacean (fig. 1) is two lines in length, and, if we do not take into consideration the wing-like processes of the thorax, has a cylindrical body gradually decreasing posteriorly, with a head, thorax, and abdomen. The thorax exhibits four, and the abdomen five segments, which are all distinctly separated from each other; so that our animal has a certain resemblance to a Woodlouse, especially as the limits of the head towards the first

* Professor Leuckart seems here to be misled by the beautiful simplicity of the etymology, which, however, is, unfortunately, by no means without parallel. *Gunenotophorus* is evidently compounded, in the simplest fashion, of the Greek words γυνὴ and νωτοφόρος, and is doubtless intended to indicate that the female carries something on her back.—W. S. D.

thoracic ring are marked with equal distinctness. The appendages are confined to the head and thorax, as usual in the Parasita. On the former we find two pairs of antennæ, and a series of oral organs which, in consequence of the nearly globular form of the head, follow each other at very short distances, and on each segment of the thorax a pair of rather short, cleft, ventral feet. (Krohn thinks he could count five pairs of feet, but he has probably taken the organs of the mouth, which are otherwise overlooked by him, as an anterior pair of feet. The figure, in fact, only shows four feet.) A remarkable character is furnished by the wing-like foliaceous processes of the dorsal segments, which are distinguished from the analogous structures occurring elsewhere in certain parasitic Crustacea by their standing nearly perpendicular, and, by the overlapping of their lateral margins, enclosing an elongated space, closed like a basket.

In the median line of the head, at a little distance in front of the antennæ, is seen a single red eye, "composed, as in *Cyclops*, of two ocelli fused together" (Krohn).

The two antennæ (figs. 3 & 4) are short and composed of only a few joints; the posterior (fig. 4) are hooked and furnished with a claw-like acute terminal joint. The animal is not unfrequently seen adhering to the walls of the respiratory cavity [of the *Phallusia*] by means of this apparatus. Moreover, it appears as if the first antennæ also occasionally perform the office of a clinging apparatus, although the want of a terminal claw and the presence of short tactile setæ certainly indicate a different destination. In the anterior antennæ I count seven joints, in the posterior only four, which in both cases gradually diminish both in length and thickness towards the apex.

The parts of the mouth are organized for biting, and not for piercing; they consist, in the first place (fig. 5), of a strong toothed mandible, immediately behind which, and in close contact with it, there is a stout three-jointed appendage, which must be regarded either as a palpus or as a second jaw,—the latter view appearing to me to be most natural, from the architectonic conditions of the Parasita. The terminal joint of this appendage bears a row of four long and strongly curved spines. The third, or second, and last pair of jaws is represented by a curved conical process (fig. 6), formed of thin, gradually diminishing joints, and bearing on its concave surface, which is turned towards the orifice of the mouth, a longitudinal series of stiff bristles or spines. The spines of the last two joints are considerably larger, but at the same time less numerous, than those of the preceding basal joint.

The legs of our Crustacean are essentially of the same structure on all the four thoracic segments. They consist (fig. 7) of

a basal joint, upon which two branches of several joints, but otherwise differently developed and destined for different purposes, are inserted. One of these branches, which is turned inwards, appears to be a swimming-foot. It consists of only two flattened joints, of which the apical one is somewhat the larger, and is furnished on its sharp margin with a number of long bristles. The other, longer, branch is formed of four cylindrical joints, which gradually diminish in size towards the extremity. Instead of the long swimming bristles, there are, on this, shorter and stiffer spines, especially on the terminal joint, where these at the same time attain their greatest development. These structures are evidently better adapted for pushing; they may do good service in creeping.

As regards the wing-like processes of the thoracic segments, these (figs. 1 & 2) appear to be folds, and not separate, independent appendages. They are therefore to be compared less with the wings of insects than with the laminar processes so often occurring in the Parasitic Crustacea; although, as already remarked, they differ from these in their position. The two middle segments of the thorax each bear two such laminæ, to the right and left, whilst the anterior and posterior segments are furnished with only a single leaf, which is curved to form a furrow, as if here the two lateral leaves, touching each other at an angle, had become fused together at their inner margins. The concavity of the anterior leaf is turned backwards; that of the posterior one, on the contrary, is directed forwards. At the same time the laminæ gradually become broader as they depart from the base, so that the margins overlap, and the space enclosed by them becomes limited on all sides. The anterior leaf stands most perpendicularly; whilst the posterior one is most inclined, but at the same time is the longest. The free margins of the leaves are usually (the posterior angle of the third leaf most constantly) furnished with one or more small points, but never with such long and beak-like teeth as are represented in Costa's figure.

Of the five segments of the abdomen, the first three gradually increase in length, whilst the last two again become shorter. The total length of the abdomen is nearly the same as that of the thorax, but its thickness is less than that of the thorax even at the first segment (which, however, is not counted as a segment by Krohn), and from this gradually becomes less to the apex. There are no appendages upon the two styles representing the *furca*, which include the anus between them, and are furnished at the extremity with three minute tubercles.

In the specimen figured by Krohn (fig. 2), we observe in the last segment of the thorax, immediately below the leaf attached

at this point, a great mass of eggs, which are characterized by a grass-green colour (brownish, according to Costa), and shine through the outer coverings. According to Krohn, these eggs are contained in the oviducts, which open here (above the abdomen). The ovaria, with their very numerous small ova, lie, in the form of one or two pair of sacs, in the lateral parts of the body, where they may be traced, partly beside and partly above the intestine, nearly to the head.

The nutritive canal is a brown tube, somewhat broader in the thorax than in the abdomen, and without appendages. The central nervous system consists, as stated by Krohn, of an elongated ganglionic mass, situated in the anterior part of the thorax, from which a number of nerves proceed, of which two stems, distinguished by their length and thickness, may be traced into the abdomen.

According to Costa's figure, the embryos have the ordinary *Monoculus*-form; they were not observed by me. On the other hand, along with the full-grown animals, I twice met with a wingless individual of about one-half their size. Whether this represents the male form, or merely an earlier stage of development, I must leave undecided.

As regards the affinities of our Crustacean, there can be no doubt that it evidently belongs to the group of the Parasitic Crustacea. Still I scarcely think that it can be arranged in any of the families already established in this group. The only form which comes near our animal is Allman's *Notodelphys,* described by him as a Lophyropod. (Annals and Mag. Nat. Hist. 1848, xx. p. 1.) But, according to Peters's Report, which is the only record now before me, *Notodelphys** is distinguished (without taking into consideration the statements regarding the structure of the mouth) especially by the absence of the dorsal leaves. The thorax also appears to be differently constructed, and perhaps disturbed in its normal development by the enormous size of the brood-sac, in the same way as in the species represented by Costa in plate 7. figs. 1 & 2 (which may be identical with *Notodelphys*?).

EXPLANATION OF PLATE XVI. B.

Fig. 1. *Notopterophorus Veranyi.*
Fig. 2. The same (from Krohn's drawing).
Fig. 3. Anterior antennæ.
Fig. 4. Posterior antennæ.
Fig. 5. Mandible with attached palpus (?).
Fig. 6. Last jaw.
Fig. 7. Leg.

* The generic name *Notodelphys* has since been used a second time for the American Pouched Frog discovered by Weinland and Lichtenstein (*N. Lichtensteinii*).

XXXVIII.—*On Additions to the Madeiran Coleoptera.* By T. Vernon Wollaston, M.A., F.L.S.

[Continued from p. 267.]

Fam. Bostrichidæ.

Genus Enneadesmus.

Mulsant, Mém. de l'Acad. de Lyon (2ième série), Scien. i. 208.

The detection of the present genus near Funchal introduces a new family into the Madeiran Catalogue, viz. the *Bostrichidæ*. Perhaps, however, properly, *Rhyzopertha* should also be regarded as a member of it, in which case it should have been long ago acknowledged in our fauna: nevertheless, since that genus is not a very typical exponent of the group, and has likewise many points in common with the *Cissidæ*, I included it in the latter family when compiling the 'Insecta Maderensia.' But now that *Enneadesmus* must be appended to the list, I would regard it, along with *Rhyzopertha*, as representing an additional family —the *Bostrichidæ*. With respect to the structural features of the insect described below, they seem to me to accord with those of *Enneadesmus*, which differs principally from *Xylopertha* (to which it is nearly related) in having its antennæ composed of only nine joints,—one of the five minute ones between the second and the very large, loosely-connected, triarticulate club (and which are so evident in *Psoa, Apate, Sinoxylon, Xylopertha*, and *Bostrichus*) having disappeared. I have a closely allied beetle in my possession, communicated from Milan a few years ago, by the Abbé Stabile, under the title of "*Apate Chevrierii*, Villa," which seems to me to belong to the same genus as the Madeiran one, its antennæ being exactly similar to those of the *E. barbatus*; so that, *if it be correctly named*, there is apparently some confusion in the recent European catalogues, which assign that species to the genus *Xylopertha*, in which the antennæ are 10-articulate. Be this, however, as it may, the Madeiran insect is certainly different specifically from the Milan one; and I regard *it*, at any rate, as belonging (for the reason above cited) to Mulsant's *Enneadesmus*. And I may here, perhaps, just add that the two insects described by M. Lucas, in his work on the Coleoptera of Algeria, as "*Xylopertha appendiculata*" and "*humeralis*," require, unless I am mistaken, to have their antennal details again carefully revised; for I cannot but suspect that a joint too many may have been assigned to the antennæ of each of them,—those of the former having, according to the figure, their second articulation divided by a central line in a manner quite unprecedented in any of the allied forms; whilst those of the latter are represented with a *small basal joint*, which is pro-

bably only the rounded commencement of what is there regarded as the second. Should my supposition prove to be correct, it would throw both of these species into the genus *Enneadesmus*, with which in most other respects they (but more especially the *X. humeralis*) appear to agree; whilst, in support of this view, I perceive that the "*Apate Chevrierii*" (which, as already stated, I consider an *Enneadesmus*, and congeneric with the Madeiran insect) has been actually registered in a late Catalogue as a synonym of the "*Xylopertha*" *humeralis*, which makes it still further probable that my suspicion is not altogether groundless.

The feet of *Enneadesmus*, like those of the allied forms above alluded to, are regarded as pentamerous; but the basal joint is so minute, and so closely connected with the second, that it is sometimes scarcely possible to detect it,—if, indeed, in all instances it does really exist. In the Madeiran insect, after mounting the tarsi in Canada balsam for the microscope, I can just recognize this first articulation in the hinder pair; but in the front ones I am scarcely able to satisfy myself of its presence, though, as it is said to exist in all these immediate genera, I conclude that it is there. The tibiæ are more or less denticulated along their outer edge; and the terminal spur, especially on the anterior pair, is very large, broad, and articulated. I have not been able to obtain a type of the *Bostrichus* 3-*spinosus* of Olivier, for the reception of which the genus *Enneadesmus* was constituted; nevertheless, I assume the Madeiran insect to be distinct from it, as I can detect nothing in its outward structure to warrant the above specific name.

Enneadesmus barbatus, n. sp.

E. cylindricus, rufo-piceus; capite deflexo, ad latera et transversim in fronte (in maribus saltem, et forsan in utroque sexu) longissime barbato; prothorace (præsertim antice) pilis longis erectis paucis adsperso, postice nitidissimo minute et parce punctulato, antice mucronibus magnis asperato; elytris piceo-testaceis postice infuscatis, subnitidis, pube demissa brevi flavescente densius vestitis, sat profunde subseriatim punctatis, ad apicem retusis, parte truncata utrinque tuberculo parvo instructa necnon ad suturam in medio elevata divaricata; antennis pedibusque plus minus picescenti-testaceis.

Long. corp. lin. $1\frac{3}{4}$–2.

Habitat Maderam australem, a Dom. E. Leacock prope Funchal primo detectus; necnon ad "Praia Formosa" pauca specimina cepit Dom. Bewicke.

E. cylindrical, and more or less rufo-piceous. *Head* much deflexed, and with the hinder part (which is concealed beneath the pronotum) longitudinally strigulose; its sides and across its forehead densely tufted (at any rate, in the male sex, if not in

both) with excessively long, porrected, yellowish hairs. *Prothorax* sparingly beset with erect, but much finer and less yellow, hairs; brightly polished behind, where it is most minutely and remotely punctulated, and much roughened in front (especially towards the sides) with coarse tubercles and points. *Elytra* paler at the base (where they are more or less piceo-testaceous) than the head and prothorax; less shining than the hinder part of the prothorax, and more densely clothed with a fine, decumbent, sericeous, yellowish pile; rather deeply subseriate-punctate (the punctures, however, although large, becoming shallower anteriorly); obliquely truncated towards the apex, but not very abruptly so, and with a small tubercle on either side of the truncated portion at about the middle of the margin, and with the suture (particularly *in the centre*) much elevated and divaricate. *Limbs* more or less piceo-testaceous, the *tibiæ* and antennal club being usually a good deal obscured.

As already stated, the above insect very nearly resembles the species which I have in my collection under the name of "*Apate Chevrierii*, Villa." It is, however, rather larger; and its elytra are more coarsely punctured (especially behind), and have their truncated portion much less abrupt, and the suture very *distinctly* raised only in the centre of this truncation, where, moreover, it is divaricate. A single example of it was detected in Madeira, by Mr. Edmund Leacock, in his garden at the Quinta de São João, near Funchal; several more were shortly afterwards found by Mr. Bewicke amongst old logs of wood in a small shed or out-house, at the Praia Formosa, and I have a specimen (which, however, I have not yet very closely compared with the Madeiran ones) captured by myself in the island of Palma, of the Canaries.

Fam. Cissidæ.

Genus Cis.

Latreille, Précis des Caract. gén. des Ins. 50 (1796).

Cis puncticollis, n. sp.

C. ovato-cylindricus, fusco-niger et breviter setuloso-pubescens; prothorace subopaco minutissime alutaceo (sed haud ruguloso) et dense punctulato (punctulis parvis sed distinctis), necnon ad latera rotundato anguste marginato; elytris subnitidis dense subruguloso-punctatis, apicem versus interdum vix dilutioribus; antennis pedibusque rufo-testaceis.

Long. corp. lin. $\frac{2}{3}$–1.

Mas, capite distincte bituberculato.

Habitat Maderam, in castanetis supra Funchal a Dom. Bewicke lectus.

C. convex and cylindrical, but just perceptibly more ovate (or

narrowed anteriorly) than the *C. fuscipes,* dark brownish black, and clothed throughout with short, suberect, and rigid cinereous setæ. *Head* obtusely rounded (or subtruncated) anteriorly, and distinctly bitubercled in the males. *Prothorax* about (or perhaps scarcely) as broad as the elytra, with the sides, as well as the anterior and posterior angles, more rounded than in the *C. fuscipes,* a little *more regularly* produced in front from each anterior angle (which causes the latter to be obtusely rounded off, instead of being a little prominent as in that insect); subopake and (beneath the microscope) most minutely alutaceous, and regularly and rather densely punctured, the punctures being smaller and deeper than those of the *C. fuscipes,* as well as more *regular* and better defined (being all equal, and not composed of a *double* set as in that species); the lateral edges margined, but not so broadly as in the *C. fuscipes,* but the hinder one perhaps rather *more* evidently (though, at the same time, very delicately); and with the faintest possible indication of a dorsal line, which tends to become a keel behind, but a channel in front. *Elytra* rather less opake than the prothorax, and not appearing alutaceous when viewed beneath the microscope; also rather more uneven or rugulose, though less so than in the *C. fuscipes*; more closely and deeply punctured than in that insect, but with the same *double* system of punctures, the larger ones of which have, like the pubescence, a tendency to be disposed in longitudinal rows. *Limbs* rufo-testaceous.

Apart from the many characters to be gathered from the above diagnosis, the present *Cis,* several specimens of which were captured by Mr. Bewicke on the trunk of a decayed Spanish chestnut-tree at the Mount, above Funchal, may be known from its Madeiran ally, the *C. fuscipes,* by its smaller size, darker hue, and shorter setæ, as well as by its somewhat narrower and less margined prothorax, and its different sculpture.

Fam. **Tomicidæ.**

Genus Aphanarthrum.

Wollaston, Ins. Mad. 292 (1854).

Aphanarthrum piscatorium, Woll.

A. fusco-nigrum, pilis suberectis dense vestitum; prothorace alutaceo dense punctato, antice producto rotundato sublurido; elytris dense subseriatim punctatis et transversim rugulosis, dilute testaceis, fasciis duabus profunde dentatis nigris (una sc. magna et altera

angustiore suffusa postica) ornatis; antennis pedibusque obscure testaceis.

Long. corp. lin. $\frac{2}{3}$–$\frac{3}{4}$.

Habitat locos inferiores Maderæ, in ramis *Euphorbiæ piscatoriæ* emortuis degens.

Aphanarthrum piscatorium, Woll., Ann. Nat. Hist. ser. 3. vol. v. p. 166.

A. smaller than the *A. Euphorbiæ*, and with the pubescence rather denser, longer, and somewhat darker. *Prothorax* rather longer in proportion, though less acuminated (or more regularly and obtusely rounded) anteriorly,—where, moreover, it is free from the small marginal asperities, or tubercles, which are so evident in that species; of an altogether darker hue, the extreme apex only being of a more or less lurid yellow; sculptured much in the same manner as the *A. Euphorbiæ*, but with the punctures, as well as the under alutaceous surface, somewhat more coarse and dense; and with the obscure dorsal ridge narrower and less conspicuous. *Elytra* a trifle more densely and regularly sculptured than in that insect; and with the front fascia usually broader (or more suffused) and less broken, and the hinder one also more suffused and placed nearer to the apex, to which it occasionally altogether extends. *Limbs* dusky testaceous, being usually less obscured than those of the *A. Euphorbiæ*.

The present insect was detected by myself—and, subsequently, on the same day (the 23rd of December, 1858), by Senhor Moniz —in decayed stems of the *Euphorbia piscatoria*, between Point Oliveira and the Brazen Head, to the east of Funchal. It was through the fact of having previously captured it in Teneriffe, Palma, and Hierro, of the Canarian group, within the rotten branches of the selfsame plant, that I was induced to commence a search amongst the Euphorbias of the lower elevations of Madeira also; and the result was that the present *Aphanarthrum* and the following one (both of them being likewise Canarian) were at once added to our list. It seems to be as common throughout the maritime districts of Madeira as the *A. Euphorbiæ* is in the *E. mellifera* of loftier altitudes; for it has been taken abundantly by Mr. Bewicke and Senhor Moniz, not only towards Caniço (where we first observed it), but also at Porto Novo, and in the region beyond the Cabo Gerão, to the westward of Funchal.

Aphanarthrum bicolor, Woll.

A. pallido-testaceum et pilis paucis erectis remote vestitum; prothorace subtilissime alutaceo sparse et minutissime punctulato, antice producto necnon ad apicem ipsum acuminato incrassato,

linea dorsali, utrinque plaga longitudinali, macula transversa subpostica et linea transversa subantica (plus minus confluentibus suffusis) nigris; elytris paulo nitidioribus subdiaphanis, remote seriatim punctulatis (punctulis minutis), fasciis duabus profunde dentatis nigris (una sc. magna in medio duplici et altera angustiore subpostica) ornatis.

Long. corp. lin. $\frac{3}{4}$–1.

Variat lineis maculisque plus minus fractis, disjunctis, rarius subobsoletis.

Habitat in iisdem locis ac præcedens, sed illo paulo rarius.

Aphanarthrum bicolor, Woll., Ann. Nat. Hist. ser. 3. vol. v. p. 165.

A. pale testaceous, and of a slightly more shining and subdiaphanous surface (at any rate, as regards the elytra) than either of the other Madeiran *Aphanarthra*; also very much less pilose, there being only an extremely few (though rather long) suberect hairs scattered over its surface. *Prothorax* rather more acuminated anteriorly than that of the *A. piscatorium*, and also a little thickened (or subtuberculose) at the extreme apical margin,—but neither so much acuminated nor so distinctly roughened as in the *A. Euphorbiæ*; most closely and delicately alutaceous (when viewed beneath the microscope), but with the additional punctures, which are so numerous in the other species, excessively minute and extremely remote; with a transverse dash behind and before, a longitudinal one (connecting them at their extremities) towards either side, and a narrow dorsal line (connecting them in the centre) black; but all of them more or less confluent, and occasionally quite disjointed. *Elytra* likewise alutaceous (but, from the surface being a little rougher, or more uneven, less distinctly so), and most minutely and remotely punctulated; and with the fasciæ dark and very similar to those of the *A. Euphorbiæ*, but with the hinder one of them generally more broken and subobsolete. *Limbs* dusky testaceous.

The pale, but beautifully marked, subglabrous, and comparatively unpunctured surface of this elegant *Aphanarthrum* will immediately distinguish it from its two Madeiran allies. As already stated, it was captured out of the same plants as, and in company with, the preceding species, though somewhat less abundantly. The Madeiran specimens differ in no respect from the Canarian ones, except that they are perhaps a trifle less subdiaphanous or shining, and that their elytra are a little more coarsely alutaceous, and with their punctures (although so distant and minute) rather more perceptible. Like the *A. piscatorium*, it will probably be found to occur throughout the lower elevations of Madeira—wherever *Euphorbia piscatoria* abounds.

Genus Leiparthrum.

Wollaston, Ins. Mad. 294 (1854).

Leiparthrum inarmatum, n. sp.

L. breviter subovato-cylindricum fusco-nigrum et pilis rigidis (præsertim postice) vestitum; prothorace antice subattenuato inarmato (*i. e.* tuberculis omnino carente); elytris profunde striato-punctatis, interstitiis leviter elevatis, apicem versus plerumque paulo dilutioribus necnon ad apicem obsoletissime subtruncatis.

Long. corp. lin. $\frac{2}{3}$–$\frac{3}{4}$.

Habitat in ramis emortuis *Euphorbiæ piscatoriæ*, in inferioribus Maderæ crescentis, minus frequens.

L. short and subovate-cylindrical (having the slightest possible tendency to be expanded behind, *i. e.* towards the apex of the elytra), black or brownish-black; and more or less clothed with short, thick, rigid, cinereous, and somewhat scaly pubescence. *Prothorax* a trifle more narrowed anteriorly than in the *L. bituberculatum*, and also a little more coarsely alutaceous and punctured; and without any appearance of the tubercles in front, which are so evident in that species, as well as in the *L. mandibulare* and *L. curtum*. *Elytra* deeply and distinctly striate-punctate (the punctures being large and well defined), and with the interstices obscurely elevated; a little more suddenly terminated (or with a very slight tendency to be obliquely truncated) at their apex—where, moreover, the setæ are rather longer and coarser, and appear therefore to be more evidently disposed in longitudinal rows. *Limbs* paler.

The present insignificant little *Leiparthrum* was detected by myself in the rotten stems of the *Euphorbia piscatoria*, in company with the two *Aphanarthra* described above, in the maritime district between the Brazen Head and Caniço, to the eastward of Funchal, in which locality it was subsequently captured likewise by Senhor Moniz and Mr. Bewicke. Its rather shortened and apically-subtruncated form, in conjunction with its comparatively deeply-sculptured elytra (with their large punctures and raised interstices) and its untuberculated prothorax, will at once distinguish it from its allies, from which, moreover, in its exclusively (as I believe) Euphorbia-infesting habits it completely recedes.

Genus Cryphalus.

Erichson, in Wiegm. Archiv, ii. 61 (1836).

The diminutive insect described below I regard as a *Cryphalus*: at any rate, after carefully mounting its antennæ in Canada balsam, I cannot satisfy myself, beneath the highest microscopic power, that its funiculus is more than quadriarticulate. Indeed, so excessively minute are the three transverse joints between the

large, thickened, subtriangular *basal* one (of the funiculus) and the club, that it was some time before I succeeded in separating them at all *inter se,*—having regarded them at first as a single articulation. But having succeeded at last in mounting an antenna in a slightly curved position, so as to display this small portion to the greatest possible advantage, it became a comparatively easy matter to recognize it as made up of three subequal parts. Thus, in the Madeiran members of the *Tomicidæ,* we have the funiculus composed in *Aphanarthrum* of three joints, in *Leiparthrum* and *Cryphalus* of four, and in *Tomicus* and *Hypoborus* of five. The *C. aspericollis* is powerfully winged, the wings being densely and minutely irrorated all over with black points or punctules (but almost free from veins), and ciliated on their *lower* edge with long hairs; its tibiæ are compressed and externally spinulose.

Cryphalus aspericollis, n. sp.

C. minutissimus, cylindricus, subnitidus, nigro-piceus et setulis rigidis suberectis cinereis adspersus; prothorace irregulariter subpunctato-ruguloso, ante medium subnodoso-convexo, antice obtuse rotundato necnon mucronibus valde asperato; elytris minute seriatim punctulatis et longitudinaliter setosis, ad apicem integris; antennis pedibusque pallidis.

Long. corp. lin. $\frac{1}{2}$–$\frac{2}{3}$.

Habitat Maderam, sub cortice arborum emortuo arido hinc inde sat vulgaris.

C. minute and cylindrical, slightly shining, dark piceous-black, and sprinkled all over with rigid, suberect, cinereous, scale-like hairs. *Prothorax* irregularly but lightly punctured, and rugulose, with a small convexity on its fore disk (where it is occasionally a little more diluted or rufescent), and greatly roughened in front with coarse tubercles and points. *Elytra* very lightly seriate-punctate, and with a row of excessively minute punctules down each of the interstices; the setæ regularly disposed in longitudinal rows; rounded and entire behind. *Limbs* paler.

In its cylindrical outline and anteriorly roughened prothorax, the present minute wood-borer has all the appearance of a diminutive *Tomicus*; nevertheless, its elytra have no tendency to be obliquely truncated behind, and, as already stated, its funiculus is only 4-articulate. I detected it in abundance beneath the dry dead bark of a rotten chestnut paling, above Porto da Cruz, in the east of Madeira proper, during December 1858; and it was subsequently captured by Mr. Bewicke and myself, in the tinder-like wood of an old fig-tree, at the Feijãa dos Padres, beyond the Cabo Geram. And I have also taken it, from out of dead geranium-stems, above the Puerto of Orotavá, in Teneriffe.

[To be continued.]

XXXIX.—*On the Identity of* Morrhua punctata *and* Morrhua vulgaris. By Robert Dyce, M.D.*

[With two Plates.]

In Turton's 'British Fauna,' published in 1807, a fish is described under the name of the "Speckled Cod," *Morrhua punctata*, as a distinct and peculiar species found in the weirs at Swansea. Since his time, every succeeding author has transcribed his account of it, although each has, to a certain extent, thrown a doubt over its existence, by saying either that it is unknown to them, or that no other author appears to have noticed it.

Thus, Fleming simply copies Turton's account of it, without comment: he, apparently, never had seen it. Jenyns, besides quoting from Turton and Fleming, adds, "This supposed species I am not acquainted with, and I would venture to suggest that it is only a variety of the *Morrhua vulgaris*;" while Yarrell, besides transcribing the descriptions of these authors, adds, "No other record of this fish has appeared, that I am aware of." He also states that a fresh example was brought him, caught at the mouth of the Thames, which the fishermen called "Lord-fish," and considered to be an accidental deformity. Thus, though each has suspected its existence, there has been no attempt made at removing the doubt. Yarrell appears not to have preserved the fish, but he gives a very characteristic drawing, which strikingly resembles the numerous examples I have met with of Turton's fish.

It appears to me that I am now in possession of facts sufficient to set these doubts at rest, from having obtained so many examples, within the last few years, which correspond with Turton's Speckled Cod, with the Lord-fish of the Thames fishermen, and yet so entirely possessing the character of the common Cod as to leave not a doubt in my mind that they are all the same fish, altered only in appearance and shape,—in short, deformed from disease of the spine. In endeavouring to show this, I shall first contrast Turton's fish with the detail of appearances in my own specimen, to show their identity; and then, secondly, exhibit the evidences of the connexion of both of these with the common Cod.

Perhaps this will be more readily understood by referring to the accompanying Table of comparison, which is intended to identify Turton's fish and mine. From this it will readily be admitted that the most notable difference (setting aside the shape of the fish) is that in the number of the fin-rays; but to this particular I do not attach much importance, because, even in fish

* Communicated by the author, having been read at the Meeting of the British Association at Aberdeen, Sept. 1859.

Table of Comparison.

Speckled Cod (Turton).	Deformed Common Cod (Dyce).
Body 18 inches long.	*Body* 16 inches long.
Arched on *back*, and prominent on *belly*.	*Depth* 5 inches; circumference over first dorsal 12 inches 11 lines.
Covered above with numerous gold-yellow roundish spots; beneath with dusky specks (which are stellate under a glass).	Crown of *head*, back and sides of *body* thickly spotted brown and golden yellow, on a light brownish mottled ground; below lateral line only partially coloured; *belly* white.
Head large, gradually sloping.	*Head* large, $5\frac{1}{2}$ inches; profile sharp.
Teeth small, in several rows in the upper jaw; in the lower, a single row.	A broad band of small *teeth* in the upper jaw; a single row in lower jaw; stronger as they approach the angles of the mouth; (a row of stronger teeth on palatine bones).
Nostrils double.	*Nostrils* double.
Iris reddish; *pupils* black.	*Irides* gold bronze-colour; *eyes* large.
Chin with a single beard.	One *barbule* on lower jaw, $1\frac{3}{4}$ inch long.
Nape with a deep longitudinal groove.	Behind the eyes, on the *nape*, and extending to near the origin of 1st dorsal, a deep sulcus or groove.
Lateral line near the back, curved as far as the middle of the second dorsal fin, growing broader and whiter towards the end.	*Lateral line* high on the back, highly curved over pectoral to middle of second dorsal, of a white silvery colour, with the exception of a part before the last dorsal, on which it is entirely extinct; then straight to tail.
Upper fins and *tail* brown, with obscure yellowish spots, and darker towards the end; lower ones tinged with green.	*Ventral fins* of a dark blackish colour; all the others dark brown.
Fin Rays.	
D.14.20.18. P.18. V.6. A.19.16. C.36. (Fleming, Yarrell, Jenyns.)	D.14.19.17. P.20. V.6. A.15.18. C.33. and several shorter. Vertebræ 52.

of which there is no doubt, you find no two authors agree. Take, for example, the common Cod, as exhibited in the following Table. The three authors named differ in every particular:—

Table showing the Difference in the rays of the Common Cod, according to different authors.

Yarrell:—

D. 10 . 20 . 18. P. 20. V. 6. A. 20 . 16. C. 26.

Jenyns:—

D. 12 . 20 . 19. P. 19. V. 6. A. 19 . 17. C. 34, and several shorter.

Fleming:—

D. 12 . 18 . 16. P. 14. V. 7. A. 20 . 16. C. 36.

I next refer to the evidences of its connexion with the common Cod, which I exhibit in a similar tabular form :—

Table showing the Identity of the Morrhua punctata *with the* Morrhua vulgaris, *or Common Cod.*

1. *Jaws.* Both have the upper longer than the lower.

2. Both have one *barbule.*

3. Both have *teeth,* card-like, in several rows of unequal lengths; also on palatine bones.

4. *Head* smooth in both.

5. Both have a longitudinal *sulcus* or *groove* on nape, extending to first dorsal.

6. Both have the *lateral line* curved to middle of second dorsal, then straight to the tail.

7. Both have *three dorsals,* "commencing at one-third of the length."

8. Both have *two anals,* "the first corresponding nearly to the second dorsal, beginning a little backwarder."

9. *Caudal,* nearly even at the extremities, large and square.

10. *Ventrals* placed before the pectorals in both, narrow and pointed.

11. Number of *fin-rays* differ very slightly.

12. *Colour* of back, head, and upper half of sides, cinereous brown, obscurely spotted with yellow; lower half of abdomen white; in *M. punctata,* head, back, and sides of body of two shades of brown and yellow: belly white in both.

13. *Lateral line* forming a narrow white band; in *M. punctata,* only partially coloured.

14. *Fins* in both dusky; ventrals pale; in *M. punctata,* ventrals dark.

These, then, are the points proving the connexion between the common Cod and the Speckled Cod of authors in their external characters. It now remains to show the cause of the apparent difference, which can be seen only on dissection. My attention was first directed to this inquiry from noticing a deformity in the spine of the common Haddock similar to that which is found in *Morrhua punctata.* It gave the fish a stumpy, misshapen, bellied appearance, so like *M. punctata,* that in my subsequent examples I readily detected the same cause operating in both as a reason for their deformity. I found the spine compressed, contracted in its length, and at times curved. The vertebræ are not, as the fishermen suppose, *double* (for they call them double-boned Cod and double-boned Haddock, or "stragglers," from their being found after the other fish have left the coast), but very much thickened and compressed throughout, the greater part of the column presenting simply a bony arch, from which the lateral processes arise, the softer spongy body of each bone appearing to have been removed by absorption, while the outer bony ring or arch only remains.

Fig. 1.

Fig. 2.

Fig. 3.

The arch is also expanded laterally, arising from the pressure of one vertebra upon its neighbour, while the transverse processes are stronger, longer, and generally nodulated, presenting much the appearance of broken bones badly united. These diseased portions are neither uniform in extent nor in situation. In some examples only a few vertebræ are involved, in others the greater part of the spine is affected; again, we find the thickened part near the tail in some, while in others it is nearer the head. Occasionally two diseased portions are met with in the same fish, having a few healthy vertebræ intervening. If the diseased portion is near the head, the extent of disease is greater than when nearer the tail, and has a greater effect in the production of the deformed external appearance of the fish.

It is difficult to account for this disease of the spine. I cannot myself arrive at any conclusion upon the subject. It may be congenital. The fishermen believe it arises from accident: if so, the cause must be constantly in operation, as there is no season that I have not met with examples—I admit, however, oftener in some years than in others. It is far more common in the Haddock than in the Cod; and the fishers assert that they occasionally meet with it in the Coal-fish, the *Merlangus carbonarius*; but I have not myself seen it in that species.

I have never seen it in any large full-grown Cod, but often in Haddocks 18 or 20 inches long, which perhaps might strengthen the argument that it is congenital.

There is no difference in the flesh; it eats equally well, and is never rejected in the market.

If I might speculate, I would suggest as a cause one which, under similar circumstances, produces deformity in the human bones,—viz. debility in the vascular system, in consequence of which the bones lose their phosphate of lime, become soft and spongy, then absorbed, and the joints, as in the vertebræ before us, become thickened and enlarged—in short, rickety, as we find in the human subject.

EXPLANATION OF THE PLATES.

Plate XV.

Fig. 1. The healthy spine of the Haddock.
Fig. 2. The spine of the Haddock deformed nearly throughout its whole length.
Fig. 3. Another example of deformed spine in the Haddock, confined to the caudal extremity of the fish.

Plate XVI a.

Figs. 1 & 2. Two examples of the spines of (*Morrhua punctata*) deformed Cod. The vertebræ much compressed and thickened.

XL.—*On the Tribe* Colletieæ, *with some Observations on the Structure of the Seed in the Family of the* Rhamnaceæ. By John Miers, F.R.S., F.L.S. &c.

[Continued from p. 273.]

Division 2. **Chænocarpæ.** Flores petaliferi; fructus capsularis, dehiscens.

3. Discaria.

This genus was first established by Sir W. Hooker in 1830, and was then distinguished from *Colletia* principally on account of its smaller, cup-shaped, hypogynous disk, having an entire border, and not being perigynous, with a very remarkable involute margin: this, and the presence of petals, were well-marked characters; but these exist also in other genera since then established, which are again signalized by other distinct features. The several species of *Discaria*, with two exceptions, seem to be limited to a region formed by the provinces which border the river Plate: they are all spinose in their habit, much resembling in appearance those of *Colletia*, and consist of undershrubs or low bushes, almost aphyllous, and generally glabrous. The peculiar character which distinguishes this genus from *Ochetophila* is that of its fruit, which here also is capsular, somewhat globular, and 3-lobed, and half imbedded in the enlarged fleshy disk conjoined with the strongly ribbed cupular base of the calyx. I have pointed out in *Colletia* the easy decortication of the upper portion of the epicarpous covering, which, at the period of dehiscence, breaks away by a transverse circumscissile line; here, on the contrary, where it is thicker in texture, and half coriaceous, it opens by radiating lines into three valves, which generally remain persistent upon the margin of the disk, and thus allow its three enclosed cocci to spring out and escape. The support of the fruit appears formed of two thickened adnate cups; the inner one, somewhat the longer, is the enlarged disk, surrounded by the detruncated base of the calyx, while in *Ochetophila* this appearance does not occur, as there the basal support is thin and almost membranaceous, and the disk, not exceeding the length of the calycine cup, is not manifest. For reasons assigned in their respective places, the following species, formerly placed here, are referred to other genera: *D. australis*, Hook., to *Ochetophila*; *D. pauciflora*, Hook. fil., to *Scypharia*; and *D. Toumatou*, Raoul, as already described, to *Notophæna*.

Discaria, Hook.—*Calyx* tubuloso-campanulatus, 8–10-nervis, limbi laciniis 4–5, acutis, reflexis, æstivatione valvatis, imo demum circumscissus. *Petala* 4–5, squamiformia, ovata, unguiculata, subconvexa, stamina amplectentia. *Stamina* 4–5,

petalis vix breviora, et cum illis intra lacinias inserta: *filamenta* brevissima, erecta; *antheræ* reniformes, 2-loculares, rima hippocrepica antice dehiscentes. *Discus* pateriformis, carnosulus, margine libero, crenulato. *Ovarium* oblongum, 3-sulcatum, disco breviter immersum, 3-loculare; *ovula* in loculis solitaria, erecta; *stylus* brevis; *stigma* obtuse 3-lobum. *Fructus* subglobosus, 3-sulcatus, in calycis cupulam valde 10-costatam discoque aucto adnatam semi-immersus, epicarpio crasso coriaceo persistente 3-valvato, endocarpio hinc secedente, in coccis 3 elastice resilientibus, axin versus bivalvatim dehiscentibus, singulis monospermis. Semen *Colletiæ*.

Suffrutices *in Provinciis Argentinis præcipue vigentes, rarius in Australasia,* ramis *valde patentibus,* ramulis *spinescentibus*; folia *parvula, breviter petiolata, spathulato-oblonga, infra spinas orta, fasciculata, valde decidua*: stipulæ *minutæ, 2-lobæ, laciniis subulatis*: flores 2–3, *fasciculati e turionibus spina brevioribus cum foliis prodeuntes*; pedunculo 1-*floro, nutante.*

1. *Discaria Americana,* Hook. Bot. Misc. i. 156. tab. 44 D. Condalia spinosa, *Spr. Syst. Cur. post.* iv. 108. Condalia megapotamica, *Spr. Linn.* xv. 473;—intricatissime spinosa, ramis tortuosis, ramulis compresso-teretibus, fere aphyllis, obsolete rigide pilosulis, spinis decussatim oppositis, iterumque spinulosis, striatis, subulatis, apice calloso-pungentibus; foliis minimis, oppositis, rarius 2–3 infra singulas spinas enatis, oblongis, obtusis, serratis, imo in petiolum brevem cuneatis, reflexis, caducissimis: stipulis minimis, rudimentariis, rubris, obsolete 2-dentatis intus pilosulis; floribus 2–3, fasciculatis, nutantibus, e tuberculo sub spina stipula suffulto ortis; calyce urceolato, limbo 5-fido, petalis 5, oblongis, concavis, unguiculatis, staminibus 5 petalis paulo longioribus, et laciniis 3-plo brevioribus, erectis, filamentis brevibus, antheris ovatis, ovario oblongo, 3-sulcato, glabro, stylo calycis dimidio longitudinis, fructu 3-cocco, calycis cupula valde 10-sulcata suffulto.—Portozuelo Prov. Cordovæ (mihi lecta); in radicibus montium Prov. San Luiz et Cordova (Gillies).

I cannot find in the Hookerian herbarium the typical plant upon which Sir William Hooker founded this genus, nor any other approaching its characters; it was probably a unique specimen that remained in Gillies's own collection, which was afterwards sold and dispersed. In one of my journeys over the Pampas I found a plant in the same locality in which Gillies met with his, so that I may safely consider mine as referable to the same type, notwithstanding the want of flowers for its complete identification: it is only in fruit. The floral character given above is therefore derived from Sir Wm. Hooker's figure,

which closely resembles that of the following species, which I received from Tweedie. In its intricately spinose habit, it has quite the appearance of a *Colletia*; the spinules generally are from 6 to 9 lines long, the internodes being somewhat shorter; the leaves, including the petiole, are only 1 line in length, and half a line in breadth; they are deflected, naviculate, with a recurved apex. In Sir Wm. Hooker's figure, the peduncle is 1 line long, the tube of the calyx is 2 lines long, the same in diameter, and the border-segments half that length; the disk, adnate to the bottom of the calyx, has a narrow, free, crenulated margin. The peduncle in the fruit is much thickened, striated, and elongated to 2 lines; the capsule is globular, somewhat depressed, 2 lines in diameter, half imbedded in the persistent cup of the calyx, which is of a fuscous reddish hue, is 10-ribbed, and glabrous; the free rim of the adnate intermediate disk runs parallel above the margin of the cupuliform base of the calyx; the thick and somewhat coriaceous epicarp of the capsule splits along its grooves in the form of three persistent valves, owing to the pressure of the three cocci, which thus escape from their enclosure with an elastic spring; these cocci are thin and horny, splitting along the line of the central axis, and partly along that of the dorsal face, exactly after the manner of the *Euphorbiaceæ**.

2. *Discaria Lycioides*, n. sp.; ramulis substrictis, simpliciter spinosis, spinis decussatim oppositis, teretibus, quam eæ præcedentis gracilioribus, glabris, striatis, inter strias granuloso-punctulatis, apice calloso-pungentibus, rarius spinulis secundariis armatis; turionibus (ramulis novellis) spina tertia parte brevioribus, foliiferis et floriferis sub spinis superioribus singulatim ortis, foliis crebritate axillarum, hinc fere fasciculatis, sed vere oppositis, oblongis, remote serratis, apice mucronulatis, imo in petiolum tenuem cuneatis, glaberrimis, caducis: stipulis minimis, mucroniformibus, oppositis, sub spinis inter se linea transversali nexis; floribus e turionibus 2–4, et proximitate istorum apicem versus ramorum, hinc densiter spicatim congestis; pedunculo flore breviore; calyce urceolato, limbi laciniis 4, triangularibus, erectis, apice recurvulis; petalis 4, illis dimidio brevioribus, elliptico-ovatis, imo late spathulatis, paulo concavis; staminibus eorum longitudine; antheris ovalibus; stylo incluso; stigmate capitato-3-lobo.—Banda Oriental.—*v. s. in herb. meo* (Tweedie): *in herb. Mus. Paris*, Rio Grande (St.-Hilaire, 1873; Gaudichaud, 1638).

This plant is very like a *Lycium* in habit; its branches are straighter than in the preceding species, and are quite glabrous; its opposite spines are spreading, $\frac{5}{8}$ or $\frac{3}{4}$ inch long and $\frac{1}{2}$ an inch

* This plant will be shown in the 'Contributions,' Plate 38 A.

apart; the lower ones are bare, but towards the extremities of the branches, beneath each spine, an elongated sprout or suppressed branchlet occurs about 3 lines long, which is imbricately squamose, owing to the decussating stipules of the approximated axils; from these, both opposite leaves and flowers issue in great abundance, which thus appear fasciculated, and in this manner the extremities of the branches assume the aspect of dense spikes, richly covered with flowers. The leaves are 3 lines long, $1\frac{1}{2}$ line broad, on a slender petiole of half a line in length; they are somewhat fleshy, serrated on the edges, deeply retuse, and mucronate at the apex; the peduncle is above a line long; the calyx, including the short erect segments, is 2 lines long, and $1\frac{1}{2}$ line in diameter, and is of a reddish hue; the stamens are almost sessile in the sinus of the segments, and they, as well as the small scale-like petals, are only half the length of the segments *.

Var, β, *exilis*: glaberrima, ramulis gracillime vimineis, spinosis, spinis remotioribus, elongatis, tenuiter acuformibus, et interdum spinulosis: floribus in axillis subsolitariis.—Buenos Ayres.—*v. s. in herb. Mus. Paris*; *in herb. Jussieu* (Commerson); *in herb. Soc. Linn. Lond.* (a Jussieu missa).

This is of an extremely slender growth, and I consider it to be merely a variety of the above species; its leaves are deeply serrated, and its flowers somewhat smaller: the internodes are 6 to 8 lines apart, the needle-like spines are 9 to 12 lines long, and the spinelets 3 or 4 lines; the opposite leaves are 4 lines long, including the short petiole, and 1 line broad; the flowers, like those in Tweedie's specimen, are of a reddish colour; the peduncle is 2 lines long; the calyx, including its four segments, is 2 lines long, and, in like manner, the almost sessile erect anthers and scale-like petals are barely half the length of the short triangular segments †.

3. *Discaria longispina.* Colletia longispina, *Hook. Arn. Bot. Misc.* iii. 173;—fruticosa, glaberrima, fere aphylla, ramis ramulisque virgatis, spinosis, spinis oppositis, remotis, longissimis, sæpe arcuatis, patentibus, sæpius nudis, calloso-pungentibus: ramulis novellis sub spinis enatis, axillis decussatis foliiferis et floriferis; foliis oppositis, parvulis, elongato-ellipticis, acutis, integerrimis, rarius apice denticulatis, imo gradatim cuneatis, nitentibus, viridibus, carnosulis, nervis immersis; stipulis minutis, rubris, ovatis, apice acute 2-dentatis, longe albido-ciliatis, linea transversali sub spinis inter se

* A representation of this species will be given in Plate 38 B of the 'Contributions.'

† This variety will be represented in Plate 38 C of the same work.

connexis; floribus proximitate axillarum, hinc sæpe densiter congestis; pedunculo calyci æquilongo; calyce late urceolato, limbi laciniis 4, erectis, petalis 4, ovalibus, utrinque acutis, subconcavis, laciniis subæquilongis; staminibus petalis vix brevioribus, ovario in fundo disci crateriformis adnati margine liberi insidente, depresse globoso, 3-sulcato, glabro; stylo incluso, fructu subgloboso, calycis cupula crassa suffulto, coccis 3 secedentibus, epicarpio persistente 3-valvatim dehiscente.—In Provinciis Argentinis.—*v. s. in herb. Mus. Paris, in herb. Jussieu* (Commerson); Monte Video (Gay); Rio Grande (Gaudichaud, 1617): *in herb. Hook.*, Buenos Ayres (Tweedie, 1378); Puerto Bravo (Tweedie); Bahia Blanca (Darwin); Maldonado (Capt. King); Banda Oriental (Baird).

This differs from the preceding species in its longer and more vimineous branches, its more distant nodes, and the much greater length of its spines; its flowers also are smaller, more lobular, and paler. The floriferous gemmæ are lengthened into more distinct branchlets, with more remote decussating axils: the spines generally attain a length of $1\frac{1}{2}$ inch,—sometimes, as in Commerson's specimen, they are shorter; while in that from the Banda Oriental they are $2\frac{1}{2}$ inches long: the leaves are usually 3 lines long and 1 line broad, but occasionally they attain a length of 5 lines: the floral peduncle is 1 or 2 lines long; the calyx, including its border, is $2\frac{1}{2}$ lines long, $1\frac{1}{2}$ line in diameter; it is thin in texture, and of a pale yellow colour, probably white in the living state; the fruit and peduncle are of the size of those of *D. Lycioides*, but the persistent portion of the calyx is dark red and smooth*.

4. *Discaria spiculata*, n. sp.;—suffruticosa, glaberrima, ramulis teretibus, subcompressis, decussatim spinosis, substriatulis, fusco-viridibus, fere aphyllis; spinis subulatis, validioribus, apice calloso-pungentibus; foliis parvulis, e gemmis elongatis per paria enatis, mox caducis, oblongis, utrinque acutis, carnosulis, fere integris, enerviis, glaberrimis; stipulis oppositis, rudimentariis, acutis, sub spinis non inter se connexis; floribus solitariis, glabris, pedunculis calyce sub-brevioribus, calyce campanulato-cylindrico, subbrevi, limbi laciniis 4, dentiformibus, erectis, apice callo carnoso incrassatis, petalis minimis, laciniis 4-plo brevioribus, ovatis, utrinque acutis, subconcavis, erectis; staminibus 4, petalis æquilongis, filamentis brevissimis, antheris ovatis; disco adnato, patelliformi; ovario glabro, oblongo, stylo medium tubi attingente; fructu immaturo

* A drawing of this species will be given in Plate 38 D of the 'Contributions.'

globoso, 3-lobo, calycis cupula semicincto.—Circa Buenos Ayres.—*v. s. in herb. Soc. Linn.* (Commerson).

This is another species, existing in the herbarium of the younger Linnæus, with a ticket in his hand-writing, "circa Buenos Ayres—Commerson." It bears some resemblance in its general habit to *D. Lycioides*, but its spines are shorter and thicker, and its flowers are only one-fourth the size of those of that species. The leaves, including the petiole, are about 2 lines long, the peduncle 1 line, the calyx, including its teeth, $1\frac{1}{2}$ line long, and 1 line in diameter. The spinules are from 3–5 lines in length*.

Var. *β. gracilenta*;—ramulis gracillimis, spinis nudis, remotis, acicularibus, patentibus; foliis lineari-oblongis, imo in petiolum spathulatis, integris vel summo 2-dentatis et emarginatis, discoloribus; stipulis linea transversali nexis, nodis hinc quasi articulatis: floribus solitariis, pedunculo folio æquilongo.—In Prov. Argentinis?—*v. s. in herb. Soc. Linn. Lond.*

This plant is likewise in the herbarium of the younger Linnæus, without any locality or designation, and is probably also from Commerson's Collection; it has more slender branches, and longer needle-like spines, and the nodes are almost articulated; its leaves and flowers, too, are more minute. Its very slender spines are 1 inch long, and half that distance apart: the floriferous branchlets are only $\frac{1}{4}$ or $\frac{3}{8}$ inch in length; its leaves (including the petiole of $\frac{1}{2}$ line) are 2 lines long, $\frac{1}{2}$ line broad; the peduncle is 1 line; the calyx is $\frac{3}{4}$ line long, and $\frac{1}{2}$ line in diameter†.

5. *Discaria australis*, Hook. Bot. Misc. i. 157, tab. 45 A; Journ. Bot. i. 256; Hook. fil. Flor. Tasm. i. 69. Colletia pubescens, *Brongn. Ann. Sc. Nat.* x. 366. Colletia Cunninghami, *Fenzl, Pl. Hug.* 23. Tetrapasma juncea, *G. Don, Dict.* ii. 40;—suffruticosa, dumosa, ramulis erectis, virgatis, junceis, valde spinosis, pubescentibus, adultioribus fere glabris, subaphyllis; spinis internodio æquilongis, decussatim oppositis, patentibus, subulatis, calloso-pungentibus; foliis oppositis, lineari-oblongis, imo cuneatis, integris, acutis, aut summum versus serrulatis, apice mucronatis, crassiusculis, margine cartilagineo subrevoluto, obscure 3-nerviis, nervis omnino immersis, superne viridibus, subtus flavide glaucis, petiolo brevi; stipulis parvis, oppositis, apice 2-dentatis, sinu petioliferis, imo latis, sub spinis linea transversali nexis; floribus plurimis, e

* This species will be represented in Plate 38 E of the 'Contributions.'
† A sketch of this variety will be given in Plate 38 F of the same work.

gemma squamosa elongata parvis, congestis, glabris; pedunculo brevi, tenui, calyce suburceolato, 4-dentato, dentibus tubo æquilongis; petalis 4, lineari-oblongis, dentium calycinorum dimidio longitudinis; staminibus totidem, e basi petalorum introflexis; disco poculiformi, adnato, margine undulato, latiusculo, libero; ovario depresso, in discum semi-immerso, glabro, stylo brevissimo, incluso; fructu parvo, 3-cocco. —In Australasia et Tasmania.—*v. s. in herb. Hook.*, Cox's River et Port Jackson (A. Cunningham); in interioribus (M'Arthur); Loddan (F. Müller); Great Swanport (Backhouse); Norfolk Plains, Tasmania (Gunn).

This plant, in its general habit and floral characters, quite agrees with all the foregoing species; but it differs from them in the more membranaceous epicarp of its capsule, which splits near the margin of the cupuliform disk, and remains attached to the resilient cocci, as in *Colletia* and *Ochetophila*. It grows in sandy places, forming a mean-looking bush, 2 or 3 feet high; its branches are virgated and spinose; its spreading spines measure $\frac{1}{2}$ inch to $1\frac{1}{2}$ inch; the leaves are 4 to 6 lines long, $1\frac{1}{2}$ line broad, on a petiole $\frac{1}{2}$ line in length; the peduncle is slender, and 2 lines long; the calyx, including its segments, measures only 1 line in length and in diameter.

4. Ochetophila.

This genus, proposed, but not published, by Pöppig, was first described by Endlicher, in his Gen. Plant. (No. 5733), founded upon the *Sageretia trinervis* of Gillies, and comprising two other plants from Chile, which were designated by name only, and are still undescribed. It is distinguished from *Discaria* by many slight characters, among which is the form of its peculiar stipules. In the latter genus, the petiole springs from the sinus between the teeth of each retinaculoid stipule, the margins of which are connected with those of the opposite stipule by a transverse line. In *Ochetophila*, the petioles of the opposite leaves spring directly from the branch; they widen at their base, and embrace the stem so far that their edges meet together in the middle of the node, giving it an articulation of a different character to that in *Discaria*: in each axil above the base of the petiole is seen a broad, concave, somewhat erect, dark red, scale-like stipule, which is bifid at its apex, with ciliated margins. The structure of its flower much resembles that of *Discaria*, and the shape and formation of its fruit are similar: its petals, however, are proportionally larger, more cucullate, and they often completely hide the stamens; the free portion of the filaments is comparatively longer; the disk is like that of *Discaria*. The

flowers are more numerous, and are supported by longer peduncles. Its capsule resembles that of *Colletia*, being half-imbedded in the simple cupular base of the calyx, while in *Discaria* it appears to be surrounded by two thickened cups, the inner one being somewhat longer, originating in the growth of the adnate disk, and the protrusion of its free margin beyond the cup of the calyx: on the contrary, in *Ochetophila*, the cupuliform support is thin and almost membranaceous, and the disk is not discernible, owing to its not exceeding the length of the cup of the calyx. All the species differ in their habit from *Discaria*; they often form good-sized trees, and their branches are rarely furnished with spines, although their extremity is generally sharp-pointed; they are copiously furnished with leaves, which are much larger and three-nerved.

The typical species above mentioned is the *Rhamnus Chacaya* of Dombey, erroneously stated to have been brought from Peru; it grows abundantly near the margins of streams in the elevated valleys of the Andes, and these localities are hence called "los Chacayes," from the vernacular name of the tree. In general appearance it resembles *Notophæna foliosa*, and the two are commonly confounded in herbaria; but the absence of petals in the latter genus constitutes an essential difference. Its generic name is evidently derived from the circumstance that its species are usually found near running streams; those of *Discaria* prefer, on the contrary, dry, saline, and sandy situations. The character of the genus is here remodelled as follows:—

Ochetophila, Pöp.—Char. emend.—*Calyx* petaloideus, urceolato-campanulatus, usque ad medium 4–5-fidus, laciniis acutis, intus carinatis, calloque sub apice signatis, reflexis, æstivatione valvatis. *Petala* 4–5, oblonga, cucullata, imo attenuata, laciniis calycinis æquilonga, et cum staminibus in sinubus inserta. *Stamina* 4–5, petalis recondita; *filamenta* subulata, tenuia, erecta, apice inflexa. *Antheræ* parvulæ, ovatæ, 2-lobæ, imo profunde cordatæ et divaricatæ, apice dorsi affixæ, lobis singulatim 2-valvulatis, valva antica breviore et hinc rima hippocrepica hiantibus. *Discus* carnosus, late pateriformis, calyci omnino adnatus, margine vix libero, integro vel subcrenato. *Ovarium* depresso-globosum, 3-sulcatum, liberum, medio disci insitum, et eo vix immersum, 3-loculare; ovula in loculis solitaria, erecta. *Stylus* calyce dimidio brevior, 3-sulcatus, glaber. *Stigma* obtuse 3-lobum, lobis paulo divaricatis. *Fructus* globosus, *Notophænæ* similis. Semen *Colletiæ*.

Frutices *arborescentes et erecti vel demissi et decumbentes, in Andibus Chilensibus vigentes, foliatione et inflorescentia ut in* Notophæna, *sed stipulis diversis.*

1. *Ochetophila trinervis,* Pöp., Endl. Gen. No. 5733.—O. Hookeriana, *Reiss. in Gay, Chile,* ii. 39.—Sageretia 3-nervis, *Gill. et Hook. Bot. Misc.* iii. 172.—Colletia inermis, *Clos in Gay, Chile,* ii. 36; C. Doniana, *Clos, loc. cit.* ii. 36.—C. Chacaye, *G. Don, Dict.* ii. 35.—Rhamnus linearis, *Clos, loc. cit.* ii. 21. Rhamnus Chacaya, *Domb.*;—arbuscula 2–3-orgyalis, glabra; ramis teretiusculis, ramulis teretibus, subvirgatis, subpendulis, valde foliosis, inermibus, vel apice interdum spina terminatis; foliis oppositis, elliptico- vel lanceolato-oblongis, obtusiusculis et mucronulatis, integerrimis, supra viridibus, subtus glaucis, imo in petiolum brevem decurrentibus, 3-nerviis, nervis lateralibus margine parallelis, eveniis; stipulis intrapetiolaribus, latis, erectis, 2-dentatis, ciliatis, utrinque in lineam transversalem connexis; floribus subternis, fasciculatis, folio multo brevioribus, 4-meris, rarius 5–6-meris, pedunculo imo bracteato, glabro, calycis tubo urceolato, quam pedunculus 2-plo breviore, laciniis reflexis, tubo æquilongis, petalis oblongis, concavis, late unguiculatis, erectis, longitudine laciniarum; fructu parvo, 3-cocco.—In Andibus Chilensibus.—*v. v.* locis humidis in vallibus circa Mendozam (los Chacayes dictis).—*v. s. in herb. Hook.*; Chile, La Guardia (Gillies, Cuming, 242); Chile (Bridges, 142).—*in herb. meo*; Cordillera de Maule (Germain).—*in herb. Mus. Paris*; Cauquenes (Gay, 359); Cordillera del Hurtado, alt. 2015 met. (Gay, 525).

This species has an extensive range along the skirts of the Cordillera; but I doubt its existence near the sea-coast, though Bridges's specimens are referred to as from Valparaiso, that being the place whence they were sent: this error of locality is frequent among the specimens of Bridges and other collectors. Its range extends as far to the southward as Concepcion, where it forms a tree 18 feet in height, with a trunk 18 inches in diameter, the wood being very durable, even in the ground; for which reason it is used in building the cottages of the natives: an infusion of its bark is also employed there in the cure of ulcerous swellings. I met with it on the eastern side of the Andes, where it forms a pretty tree, with long, slender, pendent branches, with abundant delicate foliage, and copious small white flowers. Its leaves, with three parallel prominent nervures, are from 6–9 lines long, 2–3 lines broad, on a slender petiole 1 line in length: the pedicels are 2–2½ lines long, slender, the flowers being a line in length, and the same in diameter; the capsule is 1½ line diam. The specimens from Germain's collection, distributed as the *Rhamnus linearis,* Clos, belong to this species *.

* A drawing of this species will be given in the 'Contributions,' Plate 39 A.

2. *Ochetophila prostrata*, n. sp.;—Colletia nana, *Clos in Gay, Chile*, ii. 37;—fruticosa, humilis, inermis, ramis nodosis, cortice nitido solubili; ramulis brevibus valde foliosis; foliis parvulis, oppositis, creberrime aggregatis, spathulato-ovalibus, obtusis, integerrimis, crassiusculis, margine subrevoluto, supra pallide viridibus, utrinque bullato-resinosis, brunneo-maculatis, rigide pilosulis, subtus hepaticis, longius pilosis, petiolo brevi canaliculato; stipulis 2-dentatis, intrapetiolaribus, erectis, acutis, rigide ciliatis; floribus axillaribus, solitariis, glaberrimis, proximitate foliorum quasi aggregatis, pedunculo folio fere æquilongo; calyce cylindrico, imo inflato, limbi laciniis 4, acutis, reflexis, tubo tertia parte brevioribus; petalis 4, laciniis brevioribus, oblongis, erectis, concavis, unguiculatis; staminibus totidem e basi introflexis; antheris ovato-rotundis, medio dorsi peltatim affixis; disco crateriformi, margine integro; ovario subgloboso fundo disci insito, 3-sulcato; stylo brevi incluso.—In Andibus Chilensibus excelsioribus.—*v. s. in herb. Hook.*, declivitate orientali (Bridges, 1209).—*in herb. Mus. Paris*, Chile (Gay); specimen typicum *Colletiæ nanæ*, Clos.

This is an alpine shrub, of diminutive size and prostrate growth, with an abundance of small foliage and with copious small pendent flowers; it is closely allied to the preceding species, but has a more cæspitose habit, with much longer peduncles, and a longer calyx. Its leaves, including the short petiole, are 3 lines long and 1 line broad; those of the flowering shoots are only half this size: the stipules are very conspicuous, differing from those of *Discaria* and *Notophæna* in being intrapetiolar, while the margins of the opposite petioles are continued in a transverse line across the stem: the peduncles are 1–2 lines long; the tubular calyx, somewhat contracted in the middle, is $1\frac{1}{2}$ line long, the lobes of its border being $\frac{1}{2}$ line in length. Bridges's specimen corresponds with Dr. Clos's *Colletia nana* *.

3. *Ochetophila parvifolia*, n. sp.;—suffruticosa, humifusa, ramosa, inermis, ramis validioribus, cortice nitido solubili, ramulis brevibus aut longioribus, nodis subarticulatis, approximatis, foliosis; foliis subfasciculatis, minimis, spathulato-ovatis, obtusis, integerrimis, carnosulis, navicularibus, infra subcarinatis, enerviis, pallide viridibus, glaberrimis, utrinque bullato-resinosis et brunneo-punctatis, petiolo brevi, canaliculato; stipulis oppositis, rubellis, ut in præcedente; floribus paucis; calyce urceolato, tubo subbrevi, limbi laciniis 4, acutis; petalis 4, laciniis multo brevioribus, cucullatis; staminibus totidem iis brevioribus; antheris ovalibus; ovario 3-lobo, in

* This plant will be figured in the 'Contributions,' Plate 39 B.

fundum disci crateriformis insito; stylo brevi, stigmatis lobis 3, arcte adpressis.—In Andibus Chilensibus excelsioribus.—*v. s. in herb. Hook.*, Cordillera, in præaltis (Bridges).

This also is a dwarfish species, which attaches itself to the surface of rocks, like the preceding species; but it appears to be somewhat more erect, with stouter and straighter branches, which are closely beset with very short branchlets, all covered with shorter, more numerous, and more minute leaves. In the specimen above cited, the flowers are only in bud, and few are developed; these, however, are sufficient to show their structure. The leaves, with their petioles, scarcely exceed $1\frac{1}{2}$ line, or at most 2 lines in length, and 1 line in breadth. The flowers are smaller than in the preceding species. It has much the habit of the *Rhamnus microphyllus* of Kunth (tab. 616), but with still smaller leaves*.

4. *Ochetophila riparia*, Pöpp. MSS.

5. *Ochetophila divergens*, Pöpp.

No description has yet been given of these two species, their existence only being indicated in Endlicher's 'Genera Plantarum' (No. 5733), where they are stated to have been found by Pöppig in Chile.

5. Adolphia.

This must be considered in some degree as an aberrant genus of the *Colletieæ*, amongst which it has been placed by Endlicher. My reason for this doubt is founded on the structure of its calyx, which is cleft down to the limit of the adnate disk, the consequence of which is that the stamens appear to originate outside the margin of the disk, as in the *Rhamneæ*, thus divesting it of one of the peculiar and distinctive characters of the *Colletieæ*; on the other hand, the species on which the genus is established has opposite leaves,—a feature rarely or imperfectly developed in the *Rhamneæ*. I have also noticed, in the structure and mode of dehiscence of the anthers, another character found in some of the genera that follow, which I do not see recorded in any species of the *Rhamneæ*. Dr. Asa Gray remarks (Pl. Wright. p. 34) that *Adolphia* hardly differs from *Colubrina*, which may be true in some degree, as far as regards the structure of the flower; but that genus has alternate leaves. *Ceanothus* is in the same category, although its fruit, as in *Colubrina*, is said to be exactly like that of *Colletia*, *Adolphia*, and some other genera of the *Colletieæ*. Brongniart's remark† on this

* A representation of this species will be given in Plate 39 c of the 'Contributions.'

† Ann. Sc. Nat. x. 367.

point is more conclusive; for he states that *Adolphia* differs from *Ceanothus* and *Colubrina* in the form of its calyx and petals, its simple style, opposite leaves, and spinose branchlets, which are all floriferous below.

ADOLPHIA, Meisn.—*Calyx* campanulatus, brevis, ultra medium 5-fidus, laciniis acutis, intus carinatis et callosis, æstivatione valvatis. *Petala* 5, ovata, cucullata, imo unguiculata, stamina amplectentia. *Stamina* 5, inter lacinias calycinas cum petalis infra marginem disci inserta; *filamenta* complanata, erecta, apice inflexa; *antheræ* rotundatæ, cordatæ, 2-lobæ, connectivo reniformi dorsali affixæ, rima hippocrepica 2-valvatim dehiscentes, et hinc demum peltatim apertæ. *Discus* crateriformis, carnosulus, magnitudine tubi calycis, et ei arcte adnatus. *Ovarium* in fundum disci insitum, et paululo immersum, depresso-globosum, 3-loculare; *ovula* in quoque loculo solitaria, erecta. *Stylus* brevis; *stigma* obtusum, 3-lobum. *Fructus* capsularis, 3-coccus, ut in *Colletia*.

Frutex *Mexicanus, ramosissimus, spinosus*, ramulis *oppositis, teretibus, sæpius spina terminatis*; spinis *patentibus, decussatim oppositis, rigidis*; folia *opposita, longe linearia, integerrima*; flores *solitarii, axillares, quasi fasciculati.*

1. *Adolphia infesta*, Meisn.; *Benth. Pl. Hartw.* 286; *A. Gray, Pl. Wright.* 34.—Colletia infesta, *Brongn. Ann. Sc. Nat.* x. 366.—Ceanothus infestus, *H. B. K.* ii. 31.—Colubrina infesta, *Schl. Linn.* xv. 468;—Frutex 3–4-pedalis, ramosissimus, spinosissimus; ramis ramulisque patentibus apice spinescentibus, junioribus retrorsum hirtellis, spinis decussatis; foliis parvis, oppositis, anguste lanceolatis, apice mucronatis, integris, crassiusculis, pilosulis, demum glabrescentibus, subtus pallidioribus, brevissime petiolatis; stipulis parvis, oppositis, gibbosis, squamiformibus, fusco-rubellis, 2-fidis, laciniis lineari-acutis, erectis, ciliatis, sinu petioliferis; floribus 2–6, in gemmam squamosam congestis.

Hab. Mexico.—*v. s. in herb. Hook.*, Zacatecas (Coulter, 10); El Paso, Nov. Mex. (Wright, 91).

[To be continued.]

XLI.—*Characters of new Cingalese Land-Shells collected by* F. Layard, Esq., Ceylon Civil Service. By W. H. BENSON, Esq.

Helix Rosamonda, B. n. s.

Testa perforata, turbinata, tenui, arcuatim rugose striata, superne lineis confertis granulatis, infra striis obsoletis spiralibus decussata, luteo-olivacea, spiram versus fuscescente; spira conica, lateribus

convexiusculis, apice acuto, sutura submarginata, demum impressa; anfractibus $6\frac{1}{2}$ convexiusculis, ultimo rotundato, ad peripheriam obsolete angulato, antice non descendente, subtus convexo; apertura obliqua, rotundato-lunari, peristomate recto, acuto, margine columellari reflexiusculo albido, superne supra perforationem patente, breviter reflexo.

Diam. major 37, minor 33, axis 24 mill.; apert. longa 19, lata 20 mill.
Habitat ad Pittewelle, pagi Matelle orientalis.

Its nearest Cingalese ally in form is the little solid *H. Gardneri*, Pfr. From *H. subdecussata*, which occurs at Kaloopanec, in the same district, the adult shell is at once distinguishable by its tumid non-carinate figure below, the rounded last whorl giving token only of an obsolete angle. There is also a difference in the decussate granulate spiral sculpture, and in the more convex whorls. A shell from Lagalle, which may possibly be the young of *H. Rosamonda*, has a carinate periphery; but the form is less broad in proportion than that of *H. semidecussata*.

Helix Cyix, B. n. s.

Testa profunde perforata, depresso-globosa, tenuiuscula, superne oblique et regulariter confertim costulata, lineis impressis spiralibus remotiusculis subgranulatim decussata, subtus nitida, radiatim striatula, cornea, superne saturatiore, fascia angusta fusca obsoleta, altera latiore pallida, vix conspicua, superne concurrente ad peripheriam cingulata; spira convexo-conoidea, apice obtusiusculo, sutura impressa submarginata; anfractibus $4\frac{1}{2}$ convexiusculis, sensim accrescentibus, ultimo ad peripheriam obtuse angulato, non descendente, subtus convexo; apertura obliqua rotundato-lunari, peristomate recto, tenui, infra valde arcuato obtuso, margine columellari arcuatim descendente, leviter incrassato, superne triangulatim vix expanso.

Diam. major 23, minor 20, axis 15 mill.
Habitat in pago Matelle.

It differs from the typical *H. coriaria*, Pfr., in the thinness of the shell, colouring, its regular and delicate sculpture, non-obtect narrow umbilicus, arcuate margin of the columella and base of the peristome, which is more regular in contour, and by the absence of any descent of the last whorl. It is not to be confounded with a small depressed var. of *H. coriaria* furnished with an angulate periphery, but in other respects corresponding with Pfeiffer's type, and bearing to it nearly the same relation which the pretty *H. albizonata*, Dohrn, does to *H. Gardneri*, Pfr.*

It seems to be a characteristic of several Cingalese *Helices* to have an angulate or carinate ally differing in details of sculpture

* *H. Cyix* is allied to *H.* (*Nanina*) *taprobanensis*, Dohrn, page 206, Malak. Blätter for 1859, received since this paper went to press, but may be known by its more globose form, less dilated aperture, &c.

and other particulars. Thus we have *H. Rosamonda* and *H. semidecussata,* and the Pfeifferian and Reevian types of *H. Emiliana,* Pfr., as figured in Chemnitz and the 'Iconica.' Of these I have specimens before me, collected by Mr. F. Layard; and, with reference to the difference of form and sculpture, I regard them as distinct species, notwithstanding Pfeiffer's citation of Reeve's figures for his species. Not possessing the typical form of *H. coriaria,* I cannot speak decidedly in regard to the small depressed variety of that shell with an angular periphery. I subjoin the characters of Reeve's type of *H. Emiliana.*

Helix Cingalensis, B. n. s.

Testa perforata, conoideo-lenticulari, superne confertim et arcuatim costulata, striis confertis spiralibus granulatim decussata, lutescenti-cornea, translucente, subtus nitidula, radiatim striatula, striis obsoletis spiralibus vix sculpta; spira conoidea apicem versus attenuata, demum acuta, sutura marginata; anfractibus 6 convexiusculis, lente accrescentibus, ultimo non descendente, ad peripheriam acute compresso-carinato, carina marginata, basi modicè convexa; apertura obliqua, late angulato-lunari, peristomate simplici recto, margine columellari superne breviter triangulari-reflexo.

Diam. major 17, minor 15, axis 9 mill.

Syn. *Helix Emiliana* Reeve, Conch. Icon. pl. 108. f. 608 *a, b.*

Hab. in pago Matelle.

The radiating ribs above are arcuate, the spiral ones closely set, and about double the number in each whorl compared with the true *H. Emiliana,* from which it also differs in its very acute keel and marginate sutures. The apex is also more attenuate and acute, and the base is less convex. The difference in the two species will be evident on comparing Reeve's figure with that given in Küster's 'Chemnitz,' pl. 158. f. 33–5. Pfeiffer's typical shell was got by Mr. F. Layard at Maduranatagalle, near Ellegamme in East Matelle.

Helix regulata, B. n. s.

Testa vix perforata, depressa, tenui, oblique obsolete striatula, utroque spiraliter elegantissime acuducto-striata, fusco-cornea, pellucida, politissima; spira depresso-conoidea, apice obtusiusculo, sutura impressa submarginata; anfractibus $3\frac{1}{2}$ convexiusculis, celeriter accrescentibus, ultimo ad peripheriam subangulato, subtus convexiore, antice non descendente; apertura ampla, obliqua, rotundato-lunari, peristomate recto, acuto, margine columellari arcuatim descendente, superne supra perforationem reflexiusculo, marginibus remotis subconniventibus, callo tenui junctis.

Diam. major 11, minor 9, axis 6 mill.

Habitat ad Kaluganga, pagi Matelle orientalis, necnon ad Katukellekande.

Distinct in appearance from any of the known small translu-

cent *Helices* of Ceylon, and remarkable for the beautiful spiral impressed sculpture on both sides.

Helix miccyla, B. n. s.

Testa imperforata, globoso-conoidea, tenui, striatula, nitidula, fusco-cornea, translucente; spira truncato-conica, sutura impressa, apice obtusissimo; anfractibus 4 convexis, ultimo globoso, antice sensim descendente; apertura lunato-rotundata, obliqua, peristomate acuto, margine dextro arcuato, columellari acuto, verticali, cum basali angulum fere rectum efformante.

Long. $1\frac{1}{2}$, diam. 1 mill.

Habitat ad Matelle.

Allied to *H. Orcula*, B., of North-eastern India, but smaller, destitute of the peculiar sculpture of that species, and distinguished by its very obtuse apex and by the formation of the columellar lip. It was found by Mr. F. Layard on the bark of an orange-tree near his house at Matelle.

Achatina serena, B. n. s.

Testa ovato-pyramidata, solidiuscula, politissima, obsolete vix striatula, fulvo-cornea, pellucida; spira elongata, subturrita, apice subito obtusato, sutura impressa, submarginata, crenulata; anfractibus $6\frac{1}{2}$–7 subconvexis, superne prope suturam breviter convexis, ultimo ad basin vix compresso; apertura verticali $\frac{3}{7}$ longitudinis æquante, subtriangulari-ovata, peristomate recto obtusiusculo, margine columellari valde arcuato, albido-calloso, ad basin abrupte et oblique truncato.

Long. 20–21; diam. 9–$9\frac{1}{2}$ mill.; apert. 9 mill. longa, $5\frac{1}{2}$ lata.

Habitat ad Akurambodie, pago Matelle septentrionali.

Distinguished from the stouter and shorter variety of *A. inornata*, Pfr., by its shorter and more obtuse spire, by the subangulate form of the whorls below the suture, and by its smoothness and polish. In the latter feature, also, it differs from *A. parabilis*, B., which it exceeds in the comparative length of the spire. As in *A. inornata*, there is a more slender variety, 21 mill. in length by 9 in diameter.

Achatina panætha, B. n. s.

Testa ovato-oblonga, tenui, obsolete striatula, nitidissima, pellucida, olivaceo-cornea; spira ad apicem obtusiuscula, lateribus convexiusculis, sutura valde impressa, vix marginata, crenulata; anfractibus $6\frac{1}{2}$ convexiusculis, superne prope suturam breviter convexis, ultimo $\frac{1}{3}$ longitudinis superante ad basin compressiusculo; apertura subverticali, subtriangulari-ovata, peristomate crassiusculo, obtuso, polito, albido, marginibus callo inconspicuo junctis, colu-

mellari arcuato, ad basin oblique truncato, intus plica obliqua spiraliter ascendente.

Long. 13; diam. 6 mill.; apert. 5 mill. longa, 3 lata.

Habitat ad Ellegamme Nalande, et aliunde in pago Matelle.

The form is less attenuate than the Nilgherry species, *Ach. Oreas,* B.; the suture also is crenulate and more impressed.

Cyclophorus Cadiscus, B. n. s.

Testa sublate et profunde umbilicata, convexo-depressa, tenui, confertim oblique striata, sub epidermide pallide corneo-albida; spira convexa apice obtuso, sutura profundiuscula; anfractibus 5 convexiusculis, ultimo cylindrico, antice descendente; apertura obliqua, ovato-rotundata, superne angulata, peristomate duplici, interiore continuo, modice porrecto, exteriore adnato, ad dextram breviter expanso, margine columellari recto, simplici.

Diam. major 17, minor 15, axis 8 mill.

Habitat raro in pago Matelle orientali.

Remarkable among the depressed species of *Cyclophorus* inhabiting Ceylon for its deep umbilicus and convex spire.

Cyclophorus Cytopoma, B. n. s.

Testa late et profunde umbilicata, planato-depressa, subdiscoidea, vix nitidula, confertim et arcuatim rugoso-striata, fulvo-castanea, subtus pallidiore apicem versus flammis pallidioribus, et infra medium anfractus ultimi fascia fusca inconspicua ornata; spira planulata, apice non prominente, sutura profunda; anfractibus $5\frac{1}{2}$ convexis, ultimo antice sensim descendente; umbilico $\frac{2}{5}$ diametri æquante; apertura ampla, obliqua, angulato-ovali, intus lactea, peristomate simplici expansiusculo, superne acute angulato, breviter adnato, intus incrassato-labiato, margine columellari subtus recedente, dextro, superne antice arcuato. Operculo fulvo-corneo, solidiusculo, 7-spirato, convexiusculo, ad apicem foveato, intus concavo, margine externo sulco lato fere circumdato, anfractibus ad marginem carinatis, carina exteriore elevatiore.

Diam. major $24\frac{1}{2}$, minor 19, axis 8 mill.

Habitat in Insula Ceylon.

The keeled edges of the whorls of the somewhat thickened operculum form a striking character in this species, and afford indications of an approach to the operculum of *Pterocyclos.* From *C. Bairdi,* Pfr., the flat spire, the formation of the aperture, the colouring, absence of spiral striation, or angularity in the periphery, &c., sufficiently distinguish the species, which has some features in common with *C. loxostoma,* Pfr., of which also the operculum remains unknown. In some respects it resembles *C. Cratera,* B., which has, however, a double peristome and, like other allied species, a very different operculum.

Cheltenham, March 31, 1860.

XLII.—*On the History of* Echeneis. By Dr. Albert Günther.

[With a Plate.]

There is scarcely a fish of the existence of which the ancients have been equally certain, and which has so much occupied their imagination—from a power thought to be inherent in the creature to counteract the strongest physical agencies—as the *Echeneis* of the Greeks or the *Remora* of the Latins. There is scarcely a genus of fish which, from the time of its foundation by Artedi, has been considered more natural, or more completely left in its integrity, than *Echeneis*. And, finally, there is scarcely a group of fishes which, although spoken of in nearly every voyage or account of marine fishes, has been so little *comparatively* treated, and which has experienced a similar splitting up into nominal species.

I. *History of the Fish from Aristotle to Artedi.*

We find the first mention of the name of the fish in Aristotle's 'History of Animals *.' The shortness of the notice, however, and the notice itself, afford ample proof that he did not know the fish, and that he has applied the name of *Echeneis* to a Blenny †. He never could have omitted to give a description of such a peculiar organ as the suctorial disk of *Echeneis*. He describes the fish as inhabiting rocky parts of the sea, and as having fins (pectorals and ventrals) somewhat similar to feet. This does not apply to *Echeneis*, but clearly refers to *Blennius*, a genus the species of which use their fins like feet for locomotion along the vertical and horizontal surfaces of the rocks which they inhabit. Aristotle, however, and Ælian mention another fish, called *φθεὶρ, the louse*:—"In the sea between Cyrene and Egypt there is a fish about the Dolphin (*Delphinus*), which they call the Louse; this becomes the fattest of all fishes, because it partakes of the plentiful supply of food captured by the Dolphin." (Aristot. Hist. E. *κε*. 3; Ælian, ix. 7.) Schneider and Lowe are perfectly right in suggesting that this fish is the *Echeneis* of more modern writers. (Lowe, *l. c.* p. 78.) The commentator on Aristotle, Theodore Gaza, adds to this original note merely the etymological explanation of the name *Echeneis* as he found it in other ancient writers, namely its derivation from *ἔχειν* and *ναῦς*.

It is not quite clear whether the opinion that the Remora

* Aristot. Hist. Anim. ii. c. 9. *Ἔστι δ' ἰχθύδιόν τι τῶν πετραίων, ὃ καλοῦσί τινες ἐχενηΐδα, καὶ χρῶνταί τινες αὐτῷ πρὸς δίκας καὶ φίλτρα· ἔστι δὲ ἄβρωτον. τοῦτο δ' ἔνιοί φασιν ἔχειν πόδας οὐκ ἔχον, ἀλλὰ φαίνεται διὰ τὸ τὰς πτέρυγας ὁμοίας ἔχειν ποσίν.*

† See Lowe, 'Fishes of Madeira,' p. 78.

had the power of arresting vessels in their course existed at the time of Aristotle, and that he merely omitted the mention of it as very improbable, or whether it was developed at a later period. It was, at all events, a general belief in the first century P. C. We find the first mention of it in Ovid, Halieut. v. 99:

> Parva Echeneis adest, mirum, mora puppibus ingens.

Pliny devotes to it that well-known passage, lib. xxxii. cap. 1, which I need not repeat here, as it is quoted in full by Lacépède and Shaw; he brings forward two historical proofs for the fact, which consequently none of his successors dared to deny. He himself had never seen the fish; and the indistinctness of his description* wherein he compares it (from the account of the party in Caligula's vessel) with the slimy body of a *Limax*, and its mysterious powers with those of the *Concha venerea*, has led several later writers into an odd confusion of it with some Mollusk.

Oppian† and his copyist Ælian‡ are the only writers of the

* Hist. Anim. ix. c. 25 (copied from Aristotle, xxxii. c. 1).

† Halieut. i. p. 9. Oppian describes no less beautifully than Pliny this mystery of ancient zoology; and not finding the passage quoted by other writers, I may be allowed to give it here:—

> *καὶ μὲν δὴ πελάγεσσιν ὁμῶς ἐχενηὶς ἑταίρη·*
> *ἡ δ' ἤτοι ταναὴ μὲν ἰδεῖν, μῆκος δ' ἰσόπηχυς,*
> *χροιὴ δ' αἰθαλόεσσα, φυὴ δέ οἱ ἐγχελύεσσιν*
> *εἴδεται, ὀξὺ δέ οἱ κεφαλῆς στόμα νέρθε νένευκε*
> *καμπύλον, ἀγκίστρου περιηγέος εἴκελον αἰχμῇ.*
> *θαῦμα δ' ὀλισθηρῆς ἐχενηΐδος ἐφράσσαντο*
> *ναυτίλοι, οὐ μὲν δή τις ἐνὶ φρεσὶ πιστώσαντο*
> *εἰσαΐων, αἰεὶ μὲν ἀπειρήτων νόος ἀνδρῶν*
> *δύσμαχος, οὐδὲ θέλουσι καὶ ἀτρεκέεσσι πιθέσθαι.*
> *νῆα τιταινομένην ἀνέμου ζαχρηέος ὁρμῇ,*
> *λαίφεσι πεπταμένοισιν ἁλὸς διὰ μέτρα θίουσαν,*
> *ἰχθὺς ἀμφιχανὼν ὀλίγον στόμα νέρθεν, ἐρύκει*
> *πᾶσαν ὑποτρόπιος βεβιημένος, οὐδ' ἔτι τέμνει*
> *κῦμα καὶ ἱεμένη, κατὰ δ' ἔμπεδον ἐστήρικται,*
> *ἠΰτ' ἐν ἀκλύστοισιν ἐεργομένη λιμένεσσι.*
> *καὶ τῆς μὲν λίνα πάντα περὶ προτόνοισι μέμυκε*
> *ῥοχθεῦσιν δὲ κάλωες, ἐπημύει δὲ κεραίη.*
> *ῥιπῇ ἐπειγομένη, πρύμνῃ δ' ἔπι πάντα χαλινὰ*
> *ἰθυντὴρ ἀνίησιν ἐπισπέρχων ὁδὸν ἅλμης.*
> *ἡ δ' οὔτ' οἰήκων ἐμπάζεται, οὔτ' ἀνέμοισι*
> *πείθεται, οὐ ῥοθίοισιν ἐλαύνεται, ἀλλὰ παγεῖσα*
> *μίμνει τ' οὐκ ἐθέλουσα, καὶ ἐσσυμένη πεπέδηται,*
> *ἰχθύος οὐτιδανοῖο κατὰ στόμα ῥιζωθεῖσα.*
> *ναῦται δὲ τρομέουσιν, ἀείδελα δεσμὰ θαλάσσης*
> *δερκόμενοι, καὶ θάμβος ἴσον λεύσσοντες ὀνείρῳ.*
>
> Oppian, Halieut. p. 9. v. 212–236.

‡ De Animal. Natura, i. c. 36; ii. c. 17.

second century who mention the fish, and agree with each other in the principal points of its general form and qualities. Although the organ of adhesion was unknown to them, they were better informed than Pliny, describing the fish as brown, 1 foot long, eel-like, with the mouth directed upwards. Oppian, however, imagines the lower jaw to be formed in the shape of a hook, by which the fish stops a vessel.

Wotton (de Differentiis Animalium, p. 149) gives a short abstract of what earlier writers have stated.

Whilst the nature of the fish remained entirely unknown to Bellonius (*Echeneis* s. *Remora*, p. 440), Rondelet appears to have had a far more correct idea of it, and he endeavours to give a natural explanation of the powers attributed to the fish. He devotes a long chapter to it (lib. xv. c. 18. p. 436). We find that the fish was called in Latin not only *Remora* (quia remoratur naves), but also *Remilegium*; in Greek *Echeneis* and *Naucrates*, *παρὰ τὸ ἔχειν καὶ κρατεῖν τὴν ναῦν*. He clearly recognizes the discrepancies in the accounts of the different authors, and distinguishes (1) the fish of Aristotle; (2) those accounts from which the *Remora* would appear to be a snail-like animal; and (3) the fish of Oppian. Referring to Aristotle, he maintains that the *Remora* is a true fish; but, not knowing it by autopsy, he comes to the conclusion, from Oppian's account (and not without reason), that it is a kind of *Petromyzon**, a form which was well known to him. He does not maintain the assertion of the fish's power of completely stopping a vessel, but states that, after a long voyage, a vessel is covered with marine growths, its bottom becoming soaked through, and therefore it is incapable of cutting through the water with the same facility as at first. The *Remora* likes to attach itself to such vessels; and although it is not the original cause of the slower course of the ship, it is probable that the continual lateral movements of its body are gradually communicated to the vessel itself, which then considerably slackens in speed.

Aldrovandi (iii. cap. 22. p. 335) copies Rondelet in the principal points, but prefers to return to the ancient opinion of a mysterious power inherent in the fish. He gives, however, so accurate a figure of *Echeneis naucrates*, that the general external characters of the genus appear to be fixed from the year 1649.

Gesner (De Aquat. p. 410) and Jonston (Thaumatogr. lib. i. tit. i. cap. 2. art. 4. tab. 4. fig. 3) reproduce the accounts of the earlier writers, without contributing anything new to the knowledge of our fish; the latter, however, gives a rough figure, apparently taken from *Echeneis naucrates*. It is this species also, in all probability, which we find figured by Marcgrave

* Cf. Artedi, Synon. p. 90.

(Iter, p. 180); he observed the fish in the tropical parts of the Atlantic, and, without alluding to its supernatural powers, he adds, as a new fact to its history, that it adheres not only to vessels, but to other large fishes: "*Tiburoni* (Zygæna malleus) *firmiter hæret in ventre.*" Nieuhoff * says the same, very distinctly representing *Echeneis remora*, to which he applies the Dutch name of *Zuiger*. Dampier †, an accomplished sailor, was well acquainted with the "Sucking-fish," and gives a true account of its habits when accompanying a vessel. He represents the fish as being of the size of a large Whiting, and describes the "excrescence on the head of a flat oval form, about 7 or 8 inches long and 5 or 6 broad, and rising about half an inch high." This would indicate that *E. albescens* or *clypeata*, to which these statements and the figure (Voy. to New Holland, i. tab. 1. fig. 6) may be applied, grow to a length of 2 feet!

An original figure, which has been copied by several authors, is to be found in Olearius (Gottorffschen Kunst-Kammer, tab. 25. f. 2). It will be difficult to decide whether it has been taken from *E. remora* or *naucrates*, as it represents the number of laminæ of the former species, and the slender form of the body of the latter.

The figure and the account of Marcgrave have been copied by Willughby (p. 119. tab. G. 8. f. 2), by Ray (p. 71), and by Jonston (*l. c.* tab. 39. f. 8). Ruysch again reproduces both the figures from Jonston's work (Theatr. Univers. p. 7, tab. 4. f. 3, tab. 39. f. 8), and adds a third, and very bad one, in the Pisc. Amboin. p. 13. No. 13 (Coupang-Visch), tab. 7. f. 13.

II. *Foundation of the Genus, and its place in the System.*

The father of ichthyology, Artedi, recognized in the *Echeneis* of the Greeks the type of a peculiar genus, to which he gave that name, and which he characterized by "caput plagioplateum, superne striis transversis asperis notatum." (Genera, p. 14.) Finding, however, a single dorsal fin only, without spinous rays, he placed the genus in the *Malacopterygii*. All subsequent systematists and writers, from Linnæus down to Cuvier, have left its characters and its position unaltered. Voigt (System der Natur, pp. 482, 835) first directed attention to the buckler of the head being a modified dorsal fin: he pronounces it to be a fin the rays of which have been bent downwards on both sides; they are provided with small hooks, which have the same function as in several species of *Balistes*.

After Voigt, Blainville comes to the same conclusion; but both leave the fish among the *Malacopterygii*, and it was left to

* Bras. Zee- en Lant-Reize, ii. p. 274. f. 67.

† Voyage round the World, i. p. 64.

Agassiz and Joh. Müller to remove it from that order. Agassiz*, although he does not mention either Voigt or Blainville, explains the nature of the disk exactly in the same manner, and places the genus in the family of Scombridæ. Müller† also does not appear to have been acquainted with the opinion of Voigt, and draws his conclusion merely from the structure and the insertion of the ventral fins, so widely different from those in the *Malacopterygii jugulares*: he establishes for the genus a separate group (Echeneidæ) in the family of Gobioidei. The close affinity of *Echeneis* with *Elacate* was first recognized by Holbrook‡; and if *Echeneis* be placed among the Scombridæ or Gobioidei, *Elacate* must follow.

III. *Discrimination of the Species.*

The progress of our knowledge of the different species will be more easily surveyed if we divide the account according to the species themselves. Although, as we have seen, the two most common species were known to ante-Linnæan authors, they were confounded together; and even Willughby and Artedi believed that there was one species only. Linnæus (Syst. Nat. i. p. 446 §) first distinguished *Echeneis remora* and *Echeneis naucrates*, characterizing the one as "E. cauda bifurca, striis capitis octodecim," and the other as "E. cauda integra, striis capitis viginti quatuor,"—diagnoses by which later ichthyologists were led into great errors, the form of the caudal fin being considered as a constant specific character.

1. *Echeneis remora.*

We shall not commit any great error if we refer to this species, which is the most common in the Mediterranean, the more or less philosophical accounts of Ovid, Pliny, Plutarch ‖, Ælian, Oppian, Wotton, and Rondelet. The first rough figures which without any doubt represent the present species, were given by Nieuhoff, *l. c.*, and four years afterwards by Willughby, with the name of *Remora Imperati* (Appendix, p. 5, tab. 9. f. 2),—the figures of Valentyn (iii. f. 32, p. 357. n. 32) and Renard (i. tab. 1. f. 3) being very bad, and scarcely distinguishable.

Klein and Gronovius distinguish the same species as Linnæus. Whilst the former indicates several varieties of the large Indian

* Recherch. Poiss. Foss. v. p. 117 (tab. G represents the skeleton of *E. naucrates*).

† Berlin. Abhandl. 1844, pp. 158, 159.

‡ Ichthyol. South Carol. p. 104.

§ And in Amœn. Acad. i. p. 320; Mus. Reg. Ad. Frid. i. p. 75.

‖ Sympos. lib. ii. and in Vita Antonii.

species, the latter creates two different species of the smaller one*. They consider *E. remora* as being confined to the European seas. Klein (Miss. Pisc. p. 51. no. 1) describes it as "Echeneis cœrulescens, ore retuso." Gronow gives a better and more detailed description in Zoophyl. p. 75. no. 256, and in Mus. Ichthyol. i. no. 33. It would appear, from his 'System,' p. 92, that he also knew the white variety, for which he creates the name of *Echeneis parva*, identifying it, however, with *E. remora*, Linn. He received his specimen from America.

Edwards knew nothing of the nature of the fish; he believed that "it feeds on the slimy substance it finds on the skins of the greater fishes" (Gleanings, no. 210); the rough drawing in Petiver's Gazophyl. tab. 44. f. 12, is worse than any of those already referred to.

The species appears to be only an occasional visitor to the English coasts. Pennant † enumerates it for the first time among the British fishes; Turton ‡ took a specimen himself from the back of a cod-fish; and Sir J. Richardson § mentions another instance of its being found on the gills of a shark (*Carcharias glaucus*).

Duhamel ‖ gives a good description, but a miserable figure, the sucker looking more like the shell of a *Pecten*. He attributes the adhesion of the sucker to the minute spines, which, entering a body, offer considerable resistance in the direction towards the tail, but none whatever in that towards the head.

Otto Frederic Müller enumerates the fish in the 'Prodromus Faunæ Danicæ' (no. 361); but it is evidently an accidental visitor to those coasts ¶.

Two accurate observers, however, attest its occurrence in still higher latitudes, namely in Iceland: Olafsen (Reise durch Island, ii. p. 207), and Faber (Fische Islands, p. 115) (Styris-fiskr).

Of the occurrence of the fish on the coasts of North America we find the first accurate notice in the true and elaborate account of Schœpf **, who at the same time explains the fact of its being spread all over the globe, saying that he saw the fish taken from several vessels newly arrived at New York. Mitchill †† also knew the fish well, and declares a specimen taken at New York to be identical with those from the Mediterranean; whilst

* System. Ichthyol. ed. Gray, p. 92.

† Pennant, Brit. Zool. edit. 10. vol. iii. App. p. 524.

‡ Turton, Brit. Faun. p. 94.

§ Yarrell, Brit. Fish. edit. 3. vol. i. p. 671.

‖ Pêches, ii. sect. 4. p. 56, pl. 4. f. 5.

¶ I find a reference also to Osbeck, 'Voyage to China,' p. 94,—a work not accessible to me.

** Schrift. Gesellsch. naturf. Freunde Berlin, viii. 3. p. 145.

†† Trans. Lit. and Phil. Soc. New York, i. p. 378.

Richardson*, at the time of the publication of the 'Fauna Borealis,' could not yet believe in the existence of the same species on both sides of the Atlantic. Dekay has borrowed his knowledge of the fish from the authorities mentioned, and enumerates it in his valueless work on the fishes of New York (p. 309).

The occurrence of the species in the Japanese seas has been asserted by Schlegel (Faun. Japon. p. 271), and in the East Indian Archipelago by Bleeker (*E. remoroides*).

The accounts given by Bloch† deserve particular attention, because he describes a variation in the number of lamellæ in the sucker (16–20), and maintains the occurrence of the same species in the Mediterranean, the Atlantic, and the Pacific. But he continues to regard the lunate form of the caudal fin as characteristic of the species. The description given by Lacépède‡ is more detailed and correct in nearly every respect, he having used the manuscripts of Commerson as his chief authority. After quoting and criticising the ancient accounts of Pliny, he proceeds to relate the observations of Commerson on the habits of the fish. He explains the brown coloration of the lower parts by the circumstance of its being frequently fixed to other swimming bodies with the belly directed upwards and exposed to the light. He even goes so far as to say that the fish, if not attached to another body, is not able to swim on the belly, but that it is compelled to swim always on the back. This observation, however, has not been confirmed by others; and it is probable that it did not originate with Commerson, but was interpolated by Lacépède, who was then anxious to find an additional proof for his theory that those parts of a fish which are exposed to the light show a greater intensity of colour than the others. Sir J. Richardson (*l. c.*) describes its movements as a swimming with a wriggling motion like an eel, and with considerable velocity, so as to overtake with ease a vessel going before a brisk gale; and Bennett§ says that it propels itself by rapid lateral movements of the tail, attended with an awkward twirling motion. Commerson and Lacépède find the use of the sucker merely in the mechanical adhesion effected by the minute spines, by which the fish is enabled to repose, and nevertheless to accompany vessels, sharks, &c., from and with which it expects to find its food. Commerson also knew the white variety mentioned by Gronow; and Lacépède describes twelve abdominal and fifteen caudal vertebræ. The

* Faun. Bor. Amer. p. 265.

† Ausländ. Fische, ii. p. 134, pl. 172; and edit. Schneider, p. 240.

‡ Hist. Nat. Poiss. iii. pp. 146, 147, pl. 9. f. 1.

§ F. D. Bennett, Whaling Voyage, p. 271.

latter author has been extensively copied by Shaw (Zool. iv. p. 202, pl. 31), and he too gives an English translation of the passage in Pliny. The drawings accompanying all these accounts were more or less rough and imperfect; and it is Blumenbach's and Rosenthal's merit to have given for the first time figures which may be called scientific representations of the fish and of its skeleton (Abbildungen, taf. 78, and Rosenth. Ichthyotom. Tafeln, taf. 20. figs. 1–8).

Risso adds nothing to our knowledge of the habits * of the fish, but, in the 'Histoire Naturelle de l'Europe Méridionale' (iii. p. 270) he describes a remarkable variety, or even species, from the Mediterranean, with a sucker composed of twenty laminæ,—a number which I have never met with. He separates this fish from the *E. remora*, L., and applies to it the name of *E. naucrates*; it is, however, evident that Risso did not know the true *E. naucrates*; and his fish must be closely allied to *E. remora*, having twenty-two rays in the dorsal and anal fins. I have mentioned above, that Bloch also admits that the laminæ vary from sixteen to twenty in *E. remora*.

An attempt to distinguish new specific forms from the Linnæan *E. remora* has been made by Lowe †. He found that the lunate caudal was not a character common to all specimens, and that, moreover, in some the tongue was covered with asperities, and in others smooth. He called those with a truncated caudal *Echeneis jacobæa*, and those with a rough tongue *Echeneis pallida*, considering the specimens with lunate caudal and smooth tongue as *E. remora*, L. Having had apparently but few specimens for examination, he was induced to use differences in the number of the laminæ of the sucker as additional specific characters. But the difference between the extreme forms of the caudal fin is not great: every possible degree of emargination between those extremes may be observed; the most deeply notched caudal and the most truncated one do not correspond with a certain number of laminæ; the caudal, in fact, never has a posterior margin which forms a straight vertical line; and, finally, the same fin undergoes, with age, the greatest changes possible in *E. naucrates*, as we shall see afterwards. The structure of the surface of the tongue has no more specific value than the form of the caudal. Specimens with distinct asperities on the tongue are comparatively scarce; this character is merely

* He describes them in rather general terms, and it may be interesting to quote his own words : "Plus inertes qu'entreprenants, ils n'ont que des désirs modérés; plus indolents que courageux, ils se fixent sur les quilles, ou autour des bâtimens, et traînent ainsi une vie langoureuse et misérable." *E. remora*, Risso, Ichth. Nice, p. 177, and Eur. Mérid. iii. p. 269. *E. naucrates*, Risso, Eur. Mérid. iii. p. 270.

† Proc. Zool. Soc. 1839, p. 89.

indicated in others. Lowe says that it is found in specimens with nineteen laminæ in the sucker; those four in which I have found the larger portion of the tongue rough have seventeen and eighteen laminæ, and are, in other respects, entirely congruent with true smooth-tongued specimens of *E. remora*.

Dr. Bleeker* says that he had never seen the *E. remora* of the European ichthyologists. Unfortunately he used Yarrell's description for determining the species; but if he had had more opportunity of examining the descriptions of that naturalist, he would have seen that they are more of a popular character than specimens of scientific originality. Thus it happened that Dr. Bleeker examined the true *E. remora*, but described it as a different species (*E. remoroides*), deceived by some discrepancies which exist in his and Yarrell's descriptions, but not in nature. Yarrell, for instance, says that there are "two bands of minute teeth in the lower jaw, and a single band in the upper," whilst, in fact, both jaws are armed with a single band, that of the upper jaw being, however, narrower than the other. Now Yarrell frequently confounds a series of teeth with a band of teeth; and it is to be supposed that in the present case he intended to say that the teeth in the lower jaw form two series, and those in the upper a single one. Although even this is incorrect, the arrangement of the teeth may appear so to a superficial observer. This error has not been corrected in the third edition of Yarrell's work.

Finally, A. Murray separates a specimen with seventeen laminæ (a variation known long before) as a distinct species—*E. tropica* (Edinb. New Philos. Journ. 1856, iv. p. 287); the name itself has been preoccupied by Euphrasen for a different species. Murray also distinguishes between the action of the lining membrane of the sucker and that of the toothed lamellæ: "The sucker is quite sufficient for the mere purposes of adhesion, and may be probably used without the teeth or plates, when the Remora fixes itself upon rocks or stationary objects; but the plates and teeth are required to enable it to fix itself upon bodies in rapid motion." I infer, from the whole structure of the sucker, that such a separate action is not probable; the teeth, indeed, would be useless in an attempt of the Sucking-fish to attach itself to a "rock"; but there is no evidence of any one ever having seen the fish doing this.

I conclude this historical account of our first species with some remarks made by Bennett †, who had ample opportunities of observing the fish in nature, and who indicates what I think is the most natural cause of the firm adhesion of the

* Natuurk. Tydschr. Nederl. Ind. 1855, vi. p. 70.
† F. D. Bennett, Narrative of a Whaling Voyage, p. 271.

buckler, namely a vacuum effected by the laminæ, which can be erected either by the muscles during life, or artificially, after death, by impressing the spines into any body, the minute spines merely affording an additional help. "The use it makes of its sucker is much less than may be supposed: it often merely swims around the body it attends, and only fixes upon it occasionally, and for a very short time. The adhesion of the buckler is chiefly effected by the smooth membrane that margins it. After the death of the fish, and even after the head has been severed from the body, the moist membranous border of this organ adheres to a plane surface with undiminished power. One muscle can be raised and depressed by the fish, independent of the others, or all can be moved simultaneously and rapidly. Their uses are, to fix the sucker more firmly, to offer resistance in one determinate direction, and probably to liberate the sucker from its attachment by relieving the vacuum." Bennett saw "some perfectly white *Remoræ*."

2. *Echeneis naucrates.*

Although less frequent round the European coasts than *E. remora*, this species was described and figured at an earlier period and more correctly. We find it in the works of Aldrovandi *, Jonston †, Marcgrave ‡, Willughby §, Ray ||, Ruysch ¶, Seba **. Consequently its occurrence in the Mediterranean and in the Atlantic was known almost from the first. Whilst Dutertre ††, Brown ‡‡, and Parra §§, mention its frequent occurrence in the Caribbean Sea, its presence in the Indian Ocean is indicated by Leguat ||||, and in the Mediterranean by Forskål ¶¶ and Hasselquist ***. The latter gives a most accurate description of it.

After being introduced into the system as *Echeneis naucrates* by Linnæus (Syst. i. p. 446), it is found in the works of Gronow †††, Klein ‡‡‡, Bloch §§§, and Lacépède ||||||, who, following Linnæus,

* iii. cap. 22. p. 335.

† Thaumatogr. lib. i. tit. 1. cap. 2. art. 4, tab. 4. f. 3, tab. 39. f. 8.

‡ Marcgr. Iter, p. 180.

§ Will. p. 119, tab. G. 8. f. 2.

|| Ray, p. 71.

¶ Theatr. Univ. p. 7, tab. 4. f. 3, tab. 39. f. 8.

** iii. p. 103, tab. 33. f. 2.

†† Hist. Génér. des Antilles, ii. pp. 209, 222 (fig.).

‡‡ Hist. Jamaica, p. 443.

§§ Pegador, Parra, p. 94, pl. 36. f. 2.

|||| Voyage, p. 122 (fig. bad).

¶¶ Forskål, p. xiv (*Echeneis naucrates*).

*** Iter Palæst. p. 324, or, in the German edition, p. 371 (*Echeneis naucrates*).

††† Echeneis, sp. Gronov. Zoophyl. p. 75. no. 252, and Mus. Ichthyol. i. p. 13. no. 34, and Syst. ed. Gray, p. 92 (*Echeneis fusca*).

‡‡‡ Miss. Pisc. iv. p. 51. n. 2 (*Echeneis Willughbeii*).

§§§ Bloch, Ausländ. Fische, ii. p. 131, tab. 171 (coloration incorrect), and Bl. Schn. p. 239.

|||||| Lacép. iii. pp. 146, 162, pl. 9. f. 2.

distinguish it specifically by the same incorrect character from *E. remora*, viz. "cauda integra." The description given by Lacépède is of special value, as in this species also he had the advantage of using the manuscripts of Commerson, who made detailed observations on the living fish. He says that the number of the laminæ of the buckler varies between twenty-two and twenty-six; but he considers the vertical or rounded margin of the caudal fin as a constant character. An account of a rather singular manner of catching sleeping turtles by means of a sucking-fish, held by a ring fastened round its tail, appears to have originated rather from an experiment than from a regular sport. The story is copied by Shaw *.

Russell (Fishes of Coromandel, i. p. 39, pl. 49) figures a specimen with twenty-five laminæ, under the name of *Ala Mottah*, given by the natives to the fish. I do not know whether this variety is identical with a fish described by M. Liénard in the 'Quatrième Rapport Annuel sur les Travaux de la Société d'Histoire Naturelle de l'Ile Maurice' (a work not accessible to me), and shortly mentioned in Proc. Zool. Soc. 1835, p. 205, or whether the latter is a truly different species.

The first attempt to separate specifically some forms very similar to *E. naucrates* was made by Mitchill. Schœpf †, Storer ‡, and Mitchill himself § had been of opinion that the larger species of Sucking-fish on the North American coast was identical with *E. naucrates*; and Richardson || mentions its occurrence even as far northwards as the coast of Newfoundland, where it had been found by Audubon. At a later period, however, Mitchill ¶ was struck by the white margin of the fins, which is more or less conspicuous in all specimens, especially in those of younger age; he named this imaginary species *Echeneis albicauda*, which name, as is quite clear, was originally not intended for the fish afterwards described by Holbrook as *E. lineata*, but merely for specimens of *E. naucrates* with a marked white margin to the fins. We cannot expect to find the question of the existence of a second large species in the Atlantic settled by Dekay. He ** adopts for the species found at New York the name of *E. albicauda*, adding that he had never seen *E. naucrates*; he repeats from Mitchill that its principal character is the white margin of the fins; his statement, that the number of laminæ

* Zool. iv. p. 209, pl. 31 (half-grown specimen).

† Schriften der Gesellschaft naturforsch. Freunde zu Berlin, viii. p. 145.

‡ Report Fishes Massach. p. 153.

§ Lit. and Phil. Trans. New York, i. p. 377.

|| Faun. Bor. Amer. iii. p. 266.

¶ Amer. Month. Magaz. ii. p. 244.

** New York Fauna: Fishes, pp. 307, 308, pl. 54. f. 117.

varies between twenty-one and twenty-three, proves that in fact he has confounded *E. naucrates* and *E. lineata*, Holbr. He informs his readers that all the species are natives of the tropical seas, and that they are to be considered only as accidental visitors to the coast of New York ; and, a few lines further on, states that the species is not uncommon on the coast of Long Island. He mentions an instance of a specimen having ascended a considerable distance up the Hudson River. Those species which have been established on differences in the number of caudal and dorsal rays, or differences in the form of the caudal fin from that observed by Linnæus and subsequent ichthyologists in *E. naucrates*, appear to rest on a far more solid foundation. The variations, indeed, are great; and only an examination of a great number of specimens of different ages can lead us to a correct opinion on the subject.

1. We find, then, that the number of laminæ varies between twenty-two and twenty-five. Specimens with twenty-one or twenty-six laminæ are of rare occurrence. The number of dorsal rays varies between thirty-three and forty-one; that of the anal rays between thirty-two and thirty-eight. All the specimens in which these variations have been ascertained are otherwise exactly similar to one another, and especially show the same relative proportions of the different parts.

2. The caudal fin undergoes extraordinary alterations with age. In *young specimens* about 4 inches in length, *the middle portion of the fin is produced into a long filiform lobe.* This lobe gradually becomes shorter, and the fin shows a rounded margin in fishes of middle age, with the middle portion sometimes distinctly projecting beyond the level of the margin. When, finally, the fish approaches the mature state, the upper and lower lobes are produced, and the fin becomes subcrescentic or really forked. Even in this state, I have observed specimens in which the middle part of the fin is slightly produced, so that it has the appearance of having three lobes. Rüppell * has also observed slighter changes in the form of the caudal.

The following species have been founded on such variations : *Echeneis lunata* by Bancroft †, *Echeneis vittata* by Lowe ‡, a second *Echeneis vittata* by Rüppell §, and finally, *Echeneis australis* by Griffith ||.

The authors who remain to be mentioned have not contributed

* Neue Wirbelth. Fische, p. 82.

† Proceed. Comm. Zool. Soc. i. p. 134, and Zool. Journ. v. p. 411, pl. 18 (indifferent description and figure).

‡ Proc. Zool. Soc. 1839, p. 89 ; and Fishes of Madeira, p. 77. tab. 11.

§ N. W. Fische, p. 82.

|| Anim. Kingd. Pisc. pl. opp. p. 504 ; Bennett, Whaling Voyage, ii. p. 273.

anything new to the history of the fish; and we know nothing of the mode of its propagation or its development in the earliest stage of life. They state merely its occurrence in the different seas of the temperate and tropical regions. Guichenot * has found it in the Mediterranean, Webb and Berthelot † in the sea of the Canary Islands, Ramon de la Sagra ‡ in the tropical parts of the Atlantic, Cantor § in the Sea of Pinang, Bleeker in almost every part of the East Indian Archipelago, Siebold ‖ in the Japanese Sea.

3. *Echeneis lineata.*

The third species of *Echeneis* was described fifty years after Linnæus, in the year 1791, by two naturalists simultaneously, Menzies ¶ and Euphrasen **. There is at least not the slightest reason for considering them to be different; they are both distinguished by the small number of laminæ in the buckler (10), and by a somewhat slender body. Both descriptions have been taken from apparently immature specimens, the caudal fin being very convex and produced. Menzies, who has the priority, calls the species *E. lineata*; Euphrasen names it *E. tropica*. Schneider †† also gives a figure of the fish, but he erroneously considers Euphrasen's fish to be identical with *E. squalipeta*, Dald. Lacépède ‡‡ and Shaw §§ merely reproduce the account of Menzies.

4. *Echeneis squalipeta.*

The next species which we have to record is *E. squalipeta* of Daldorf ‖‖; it has not been recognized again. The specimens on which the species was founded are little more than two inches in length; nevertheless they appear to be adult, having the caudal fin emarginate. The principal character of the species is the continuation of the dorsal and anal fins to the caudal; the buckler has seventeen laminæ. The fishes have been found in the Atlantic between the tropics.

5. *Echeneis osteochir.*

Cuvier ¶¶ has added to the preceding species a fifth, which he

* Guichen. Explor. Algér. Poiss. p. 111 (if this is not *Echeneis Holbrookii*).

† Hist. Nat. Iles Canar., Poiss. p. 87.

‡ Hist. de l'Ile de Cuba, Poiss. p. 170.

§ Catal. Malay. Rept. p. 199.

‖ Schleg. Faun. Japon., Poiss. p. 270, pl. 120. f. 1 (var.).

¶ Trans. Linn. Soc. 1791, i. p. 187, tab. 17. f. 1.

** Nya Handl. 1791, xii. p. 317.

†† Bl. Schn. p. 240, tab. 53. f. 1.

‡‡ Hist. Nat. Poiss. iii. pp. 146, 167.

§§ Zool. iv. p. 211.

‖‖ Skrivt. af Naturhist. Selsk. ii. p. 157.

¶¶ Cuv. Règne Anim. and edit. Ill. Poiss. pl. 108. f. 3.

calls *E. osteochir*, from the singularly compressed and ossified rays of the pectoral: it also has not been recognized. It is badly figured in the illustrated edition of the 'Règne Animal,' and appears to have nineteen laminæ in the disk on the head.

6. *Echeneis brachyptera.*

The Rev. R. T. Lowe, who has paid so much attention to the distinction of the species of this genus, discovered a sixth. After having shortly mentioned it in the 'Synopsis of the Fishes of Madeira *,' he fixed its place in the system by the name of *E. brachyptera*, accompanying it with a proper diagnosis †. But it appears to me that the species was long ago seen, and even figured, by Catesby ‡. He calls it by the collective name of *Remora*, but expressly enumerates sixteen laminæ in the adhesive disk,—a number also indicated in the figure, which is indifferently executed and posteriorly distorted. Catesby's account is one of the truest found in the older works:—"It can fix itself to any animal or other substance: but the notion that this small fish was able to stop a ship under sail, or a whale in swimming, is entirely fabulous. I have taken five of them from off the body of a shark, which were fixed so fast to different parts of his body that it required great strength to separate them. I have seen them disengaged and swimming very deliberately near the shark's mouth, without his attempting to swallow them, the reason of which I am not able to give."

Like the other species of *Echeneis*, the present is not confined to a district of a certain sea, and was found, nearly at the same time as by Mr. Lowe, by the naturalists attached to the expedition of the French vessel 'La Favorite,' and by Storer. The former have called it *E. sexdecim-laminata* §, and think that their specimen was caught in the Indian Ocean. Storer || himself procured a young specimen with only fourteen laminæ in the disk, and named it *E. quatuordecim-laminatus*. As this difference might awaken doubts as to the specific identity of the fishes mentioned, I have carefully compared Storer's description with a Brazilian specimen evidently belonging to *E. brachyptera*, Lowe, and exhibiting fifteen lamellæ in the disk. Both agree very well, excepting a slight difference in the number of the anal rays. Storer states, moreover, that it has four ventral rays, which is evidently a mistake.

Having had the opportunity of comparing Chinese specimens with others from the Atlantic, I do not hesitate to consider the

* Transact. Zool. Soc. ii. p. 191.
† Proceed. Zool. Soc. 1839, p. 89.
‡ Histor. Nat. Carol. ii. p. 26, pl. 26.
§ Eydoux and Gervais, Voy. Favor. Zool. p. 77, pl. 31.
|| Report Fishes Massach. p. 155.

E. pallida, Schleg.* likewise as synonymous with the present species. I have found sixteen laminæ in Chinese specimens, Schlegel sixteen or seventeen. The latter number appears to indicate the highest limit, as fourteen does the lowest, within which the laminæ vary in this species; they occur only occasionally, and specimens with fifteen and sixteen laminæ are the most frequent.

Finally, a fifth name has been given to this species by Dr. Bleeker,—*E. Nieuhofii*†. He was well aware of its close affinity to the fish described by Lowe and Schlegel; but he considers the diagnosis given by the former as too brief to be taken into consideration, and finds a difference from the fish of the latter in the structure of the skin. The figures given by Nieuhof and Valentyn, which we have mentioned above, are referred to this species by Dr. Bleeker; but if he admits those into the synonymy, the diagnosis of Mr. Lowe, with the name proposed by him, would have merited it as well. The alleged difference in the structure of the skin is merely produced by the mode of preservation. Schlegel describes as a peculiarity in the Japanese fish, that its skin has a porous appearance, and that the scales are at the bottom of small cavities. The skin of Bleeker's fish is smooth, although covered with minute scales. I have seen fishes in both states: those with smooth skin are the best preserved, their skin still retaining a part of the mucus. But in specimens preserved for a longer period in somewhat weak spirit, the skin loses all the mucus, and the cavities in which the scales are imbedded make their appearance in the fishes from the Atlantic as well as from the East Indies.

7. *Echeneis albescens.*

This species was made known by Schlegel (Faun. Japon. Poiss. p. 272, pl. 120. fig. 3), and is easily recognized by the small number of laminæ in the disk (thirteen). I have found it since in a collection of Chinese fishes, and another form closely allied to it.

8. *Echeneis Holbrookii.*

I cannot claim the discovery of this species, as it has apparently been known to several of the North American writers (although they have confounded it with *E. naucrates*), and it is evident that it has been described by Holbrook. The latter, however, does not point out those characters by which it may be distinguished at once from the other species mentioned, and calls it *E. lineata*, which name had been applied long before to a different species.

* Faun. Japon. Poiss. p. 271, pl. 120. figs. 2, 3.

† Bleek., Natuurk. Tydschr. Nederl. Ind. 1853, i. p. 279.

We have seen above, that the fish named by Mitchill *E. albicauda* is in fact merely an immature specimen of *E. naucrates*; consequently this name is a synonym of that species, and cannot be applied to a second, discovered at a later period. Dekay* assigns this name to the larger species of Sucking-fish found on the coast of the United States. Most of the specimens which he professes to have examined belong evidently to *E. naucrates*; but, as he mentions also fishes with twenty-one laminæ, it is possible that he has confounded that species and *E. Holbrookii*. Guichenot† appears to have fallen into the same error: he describes a single specimen with twenty-one laminæ, caught on the coast of Algiers, as *E. naucrates*. As this species, however, also shows exceptionally a number of laminæ which is constant in the other, the question can be decided only by an autoptical examination of that individual. Holbrook was the first who described our eighth *Echeneis* as a separate species ‡. Although he does not appear to have been aware of its close affinity with *E. naucrates*, he very properly places it at the side of *Elacate*; he is, besides, decidedly of opinion that the firm adhesion of the disk to another object is effected by a vacuum produced in consequence of the erection of the laminæ.

9. *Echeneis scutata.*

(Pl. X. B.)

This is a new and most remarkable species, distinguished by the extraordinary size of the disk. Its diagnosis is as follows:

D. 27 | 22. A. 21–23.

The length of the disk is contained $2\frac{1}{3}$ times in the total length; the width of the body between the pectorals $5\frac{3}{5}$ times. Caudal truncated. Dorsal and anal fins not continued to the caudal. Colour brown.

Twenty inches long.

From the Indian Ocean (Ceylon).

10. *Echeneis clypeata.*

D. 12 | 17. A. 20.

The length of the disk is contained $3\frac{1}{7}$ times in the total, the width of the body between the pectorals 5 times. Caudal subtruncated. The lower jaw and the vomer anteriorly with a series of widely-set and strong teeth. The angle of the mouth is situated in the vertical line from the second lamina of the adhesive disk. The length of the ventral is much less than the distance between the

* New York Fauna: Fishes, p. 307.

† Explorat. Algér. Poiss. p. 111.

‡ Ichthyol. South. Carol. p. 101. pl. 14. f. 2.

root of the pectoral and the posterior margin of the eye. Uniform brown.

This is another new species from the Cape Seas, closely allied to *E. albescens*, from which it differs by its narrower mouth, its shorter ventral fin, and also by the smaller number of the laminæ of the disk. To which of the two species the figure given by Dampier (Voyage to New Holland, i. pl. 1. fig. 6) ought to be referred is a question that cannot be decided.

In conclusion, I give a synoptical review of the species enumerated*:—

a. Species with a stout and rather short body.

	No. of laminæ.
1. *E. clypeata*, Gthr.	12
2. *E. albescens*, Schleg.	13
3. *E. squalipeta*, Daldorf	17
4. *E. brachyptera*, Lowe	15–16
5. *E. remora*, L.	17–18
6. *E. osteochir*, Cuv.	19
7. *E. scutata*, Gthr.	27

β. Species with a slender body.

8. *E. lineata*, Menzies	10
9. *E. Holbrookii*, Gthr.	21
10. *E. naucrates*, L.	22–25

XLIII.—*Note concerning* Statice Dodartii *and* S. occidentalis. By C. C. Babington.

In the year 1849 I published a paper in these 'Annals' (ser. 2. iii. 433) "On the British Plumbaginaceæ," pointing out that the plant erroneously called *S. spathulata* or *S. cordata* in this country is the *S. occidentalis* (Lloyd). I also endeavoured to show that the *S. Dodartii* (Gir.) inhabited our western coasts. At that time, and until very recently, I had not seen an au-

* While this paper was passing through the press, my attention was called to the announcement of one on the same subject by M. Duméril (Compt. Rend. 1858, p. 374), in which he enumerates *forty-six species* which are to be described by him. He does not appear to be aware of the variability of the number of the laminæ and fin-rays, nor of the variation of the form of the caudal fin. He states that he has examined 161 specimens,—a number scarcely exceeding that examined by myself, the British Museum alone possessing 130 specimens. The difference in the treatment of the subject, therefore, is so great, that there is no reason to hold back this paper on account of that advertisement,—the less as, perhaps, M. Duméril may obtain from it some information that may prove useful to him.

thentic specimen of *S. Dodartii*; but now possessing one in Billot's valuable 'Exsiccatæ' (No. 1054), I have again submitted our plants to a careful examination. It was my opinion that specimens gathered at Berry Head (Devon), Giltar Head (Pemb.), and Pennard and Langland Bay (Glam.), were the true *S. Dodartii*, notwithstanding "a few slight discrepancies" in the description. But as a considerable addition has been gradually made to my set of specimens, so has my opinion tended more and more towards the belief that these plants ought not to be separated from *S. occidentalis*: the receipt of Dr. Billot's specimen of the true *S. Dodartii* shows that they are not identical with it, and removes the only difficulty that I found in considering them all as *S. occidentalis*.

The specific distinctness of *S. Dodartii* is still open to discussion, but I do not possess the materials requisite for entering upon so difficult an inquiry. All the more modern French botanists—Godron, Lloyd, and Boreau, for instance—separate them; and assuredly the authentic specimens have a very different appearance, although it is not easy to define in botanical language their distinctive points. Speaking generally, it may be remarked that *S. Dodartii* is a coarser plant than *S. occidentalis*; its stems are stouter; leaves thicker, and blunt; spikes broader, owing to the spikelets being more closely placed, and therefore more spreading; inner bracts very broad and blunt, and with a narrower scarious margin.

But at the same time that the authority for including *S. Dodartii* in the British Flora is destroyed, I am enabled to show cause for its restoration to our catalogue. There has long been an unnamed specimen of *Statice* in my herbarium, which was gathered at Portland, Dorset, in September 1832, by Professor Henslow. This is quite similar to the authentic *S. Dodartii* supplied to me by Billot, agrees well with Girard's description (Ann. Sc. Nat. 2 sér. xvii. 31), and is exceedingly like the fine old plate of *Limonium minus, Bellidis minoris folio*, to be found in Dodart's 'Mémoires' (ed. 1. p. 95). It is a coarse, inelegant plant, of a very different aspect from any state of *S. occidentalis*. The distribution of this plant has to be determined; for it is scarcely to be supposed that Portland is its only English station. Botanists visiting our south coast in the latter part of the summer would do well to pay attention to these plants, so as to determine their extent of variation and range. *S. Dodartii* seems to be the less common plant on the French side of the Channel. Lloyd only mentions it as tolerably plentiful on the north coast of Bretagne; but it seems to be more abundant on the western coast of France.

Mr. Bentham combines these two species, and gives them the

name of *S. auriculæfolia*. The plant so named in his 'Cat. des Pl. des Pyrénées' is referred by all the French botanists to the *S. lychnidifolia* (Gir.); but surely Mr. Bentham would not combine our plants with it! That would be a union more remarkable even than many of the other conjunctions of species which he expects us to accept upon his authority alone.

XLIV.—*On a Species of* Ostrea *taken from the copper sheathing on the bottom of a vessel in the Liverpool Graving Docks.* By T. C. Archer, Professor of Botany in Queen's College, Liverpool.

The great rarity of the occurrence of bivalve shells growing upon the bottoms of ships is well known to those who are engaged in the repairs of vessels; two such instances, however, have occurred in this port, within a few weeks of each other. In the first case, which did not fall under my own notice, the copper sheathing of a vessel from Bombay was found to have attached to it a considerable number of full-grown shells of a species closely allied to *Ostrea edulis*. In the second instance, I happened to pass one of our graving docks in which some vessels were undergoing repairs, and was much struck with the immense number of oyster-shells adhering to the bottom of one of them. Upon descending for the purpose of a closer inspection, I found one or two old ship-carpenters examining them with great curiosity; and they informed me that, although they had worked in the Graving Docks from their boyhood, they had never seen oysters on a ship's bottom before. I removed a few of the shells, which thickly covered the greater part of the copper, being thickest near the keel, and took them away for examination. On my return home, I saw at once that it was a species with which I was not familiar, and upon referring to the beautiful and extensive collection in the Liverpool Royal Institution, I found no specimen of the species there; nor have I been able by reference to local and distant friends to ascertain its name. I therefore hastened to secure a considerable number of specimens for distribution—and was only just in time, for they were being rapidly removed and carted away: upwards of *a ton and a half* were supposed to have been taken from the ship's bottom.

Deeply imbedded in the interstices of the clumps of oysters, I discovered some small shells attached by a byssus; these are a species of *Perna*, which Mr. S. P. Woodward obligingly informs me is known to him as a South Sea species. This is of value, as indicating the probable habitat of the *Ostrea*, otherwise a difficult matter, for very little is known of the antecedents of the vessel, she having been taken as a prize during the Russian war,

and having since then belonged to several owners. I have, however, learned that one of her latest voyages was to Matamoras.

Every shell was not only empty, but was perfectly cleaned out; from which I infer that, after the vessel came into the colder waters of the temperate zone, the oysters died, and, their shells consequently opening, they were speedily devoured by Crustaceans and other carnivorous creatures. Owing to this circumstance, by far the larger proportion of the oysters wanted their upper valves, which had dropped off, the hinge not being able to sustain the weight of the valve, which, from the oysters' position on the ship, would hang downwards.

Description of the Shell.—Attached by its lower valve, which varies in shape according to the extent of the attachment: when only slightly adherent, it is very concave. The upper valve flat, or slightly concave, and foliaceous. In some specimens there are well-marked plaits on the outer surface. The nacreous lining of the upper valve is white; that of the lower one is of a deep rich copper-brown colour in the middle, with a margin of white. The hinge toothless, with a laminated subnacreous structure.

I send you herewith specimens; and if you think that they possess any value, I shall be obliged by your making known to your readers that, to the extent of my stock, I shall be glad to give them to public museums and important private collections.

XLV.—*On some New Genera and Species of Mollusca from Japan.* By Arthur Adams, F.L.S., &c.

[Continued from p. 303.]

Genus Syrnola, A. Adams.

Testa subulata, recta, vitrea, polita; anfractibus planis; suturis impressis. Apertura oblonga; labio in medio plica obliqua instructo; labro simplici, acuto.

This genus bears the same relation to *Obeliscus* that *Chrysallida* does to *Pyramidella*, and will include all the slender species of the former group with a single plait on the columella. It differs from *Monoptygma* in being vitreous and polished, and from *Odostomia* in texture and its subulate or aciculate form.

Syrnola gracillima, A. Adams.

S. testa subulata, alba, vitrea, subopaca; anfractibus novem, lævibus, planulatis, suturis valde impressis, anfractu ultimo linea rufo-fusca angusta circumcincto, antice rotundato; labio antice expanso et reflexo, in medio plica obliqua valida instructo; labro intus subincrassato.

Hab. Straits of Korea; 63 fathoms.

Genus Stylopsis, A. Adams.

Testa subulata, opaca, lævis, non polita; anfractibus planulatis, suturis impressis. Apertura subquadrata, labio recto simplici; labro in medio recto, antice angulato.

This genus resembles *Eulimella* in the simple straight inner lip; in other respects—in surface, texture, and form—it is altogether different.

Stylopsis typica, A. Adams.

S. testa subulata, alba, opaca, non polita, vix rimata; anfractibus octo, planulatis, suturis impressis, anfractu ultimo subangulato; apertura subquadrata, columella recta, antice producta, labro margine recto, acuto.

Hab. Straits of Korea.

Genus Styloptygma, A. Adams.

Testa pupiformis, subpellucida; anfractibus convexiusculis, transversim tenuiter sulcatis. Apertura subquadrata; labio superne plica obliqua instructo; labro dilatato.

Styloptygma Stylina, A. Adams.

Proc. Zool. Soc. 1851, p. 224.

This species is so unlike any other form of *Pyramidellidæ* as to warrant its separation. Its nearest approach to any genus hitherto constituted is to *Chrysallida* of Carpenter, which, however, is longitudinally ribbed or plicate.

Genus Myonia, A. Adams.

Testa ovato-turrita, alba, tenuis; anfractibus convexiusculis, transversim sulcatis, interstitiis cælatis. Apertura oblonga, postice acuminata, antice producta; labio superne plica obliqua instructo.

This genus will include most of the species described by me as belonging to *Monoptygma* in Sowerby's 'Thesaurus,' and should be placed in the family *Actæonidæ*.

Myonia Japonica, A. Adams.

M. testa turrito-subulata, alba, subpellucida; anfractibus planiusculis, transversim sulcatis, sulcis distantibus, interstitiis punctatis; apertura oblonga, antice subreflexa; labio rectiusculo, superne plica obliqua, vix conspicua, instructo; labro intus sulcato, margine crenulato.

Hab. Straits of Korea; off Niphon.

Most nearly allied to *A. lauta*, A. Adams.

Genus Leucotina, A. Adams.

Testa ovata, alba, tenuis; anfractibus convexiusculis, ultimo ventricoso, transversim sulcatis, interstitiis punctatis. Apertura oblonga,

antice producta; labio superne plica obliqua, sæpe celata, instructo.

This genus is exactly intermediate between *Actæon* and *Myonia*, and cannot with propriety be ranked with either. It belongs to *Actæonidæ*. There are several species, one only of which I shall now describe.

Leucotina Niphonensis, A. Adams.

L. testa alba, tenui, oblongo-ovali; anfractibus $3\frac{1}{2}$, convexiusculis, transversim sulcatis, insterstitiis punctatis; apertura oblonga, antice subproducta; labio plica obliqua, vix conspicua, instructo; labro acuto, simplici.

Hab. Sixteen miles from Mino-Sima, off Niphon; Straits of Korea; dredged from 63 fathoms.

Genus Macrocheilus, Phillips.

In this genus, hitherto considered extinct, the shell is ovate-oblong, with rounded whorls, the last whorl ventricose, and the aperture with no plait on the inner lip, which is thickened. The recent species described below is almost exactly similar in form to *M. acutus*, De Koninck, but is nearly smooth, being but faintly striated under the lens.

Macrocheilus Japonicus, A. Adams.

M. testa ovato-oblonga, alba, lævi, glabra; anfractibus sex, rotundatis, sub lente transversim tenuiter striatis, anfractu ultimo ventricoso; apertura ovali, antice producta; labio calloso subincrassato.

Hab. Straits of Korea; 63 fathoms.

Genus Auriculina, Gray.

This genus is composed of thin oval shells with simple whorls and without any plait on the inner lip. It is doubtful whether its natural position is not rather in *Actæonidæ* than in *Pyramidellidæ*. The species already best known have been described as *Odostomiæ,—A. cylindrica,* Alder, and *A. obliqua,* Alder. I now add another and much larger species.

Auriculina Grayi, A. Adams.

A. testa ovato-acuta, bulimiformi; anfractibus quatuor, longitudinaliter substriatis, convexiusculis; apertura ovali, antice dilatata, postice acuminata; labio simplici; labro margine acuto.

Hab. Straits of Korea; 63 fathoms.

Genus Alcyna, A. Adams.

Testa acuminato-ovata, imperforata, spira brevi, conica, acuta; anfractibus planis, lævibus. Apertura ovalis; labio callo incrassato

intrinsecus decurrente, et in dentem acutum desinente; labro acuto intus lævi.

This little genus most nearly approaches *Elenchus*, but the form is different: the outer lip is not lirate or grooved within; and there is a peculiar defined callus (ending in a very conspicuous tooth), extending the greater part of the length of the inner lip. Only a single specimen of each species was obtained.

Alcyna ocellata, A. Adams.

A. testa lævi, imperforata; anfractibus convexiusculis, pallide carneo-rufescentibus, anfractu ultimo cingula macularum ocellatarum (pupillis rufescentibus, viridibus, albidis) ornato; callo parietali in dentem validum prominentem acutum desinente.

Hab. Sea of Japan; off Talen-Sima; dredged from 25 fathoms.

Alcyna lepida, A. Adams.

A. testa lævi nitida imperforata, pallide rufo-fusca, lineolis nigricantibus transversis circumcincta, apice nigricante; anfractibus 5, planiusculis; callo parietali in dentem parvum acutum desinente.

Hab. Sea of Japan; off Talen-Sima; dredged from 25 fathoms.

Genus Enida, A. Adams.

Testa depresso-conica, late umbilicata; anfractibus convexiusculis, cingulis concentricis granulosis aut squamulosis ornatis, suturis canaliculatis, anfractu ultimo ad peripheriam carinato vel angulato. Apertura subquadrata; labio in medio reflexo; labro intus simplici aut lirato; umbilico amplo, margine crenulato.

I have dedicated this genus to the gentle Lady Enid of the Poet-Laureate's 'Idylls of the King,'—a creation of the brain more beautiful, more tender, and more pure, than any of the so-called goddesses of the Greek mythology who have lent their names to science. *Enida*, founded on shells of great beauty and of exquisite sculpture, resembles a depressed and widely umbilicated *Zizyphinus* with the inner lip reflexed; in form it also approaches many species of *Gibbula*, but this group is littoral and coarser in its physiognomy. Deep-water shells are usually more delicate and of finer sculpture than those which have to buffet with the tides.

Enida Japonica, A. Adams.

E. testa depresso-conica, profunde umbilicata; anfractibus $5\frac{1}{2}$, convexiusculis, liris transversis granulosis (interstitiis oblique longitudinaliter striatis) ornatis, anfractu ultimo ad peripheriam carina crenulata prominente cincto; apertura subquadrata, labio in medio reflexo, labro intus lævi, basi liris concentricis granulosis confertis instructa; umbilico mediocri. Colore pallide fusco, maculis radiantibus fuscis ornato.

Hab. Off Mino-Sima; 63 fathoms.

This appears to be the most abundant species but all the

specimens I obtained in the dredge were dead shells. In this species and *E. speciosa* the inner lip is smooth within, but in *E. gemmulosa* it is internally thickened and lirate and crenate at the margin; in *E. Japonica* the aperture is also less circular in its outline.

Enida speciosa, A. Adams.

E. testa depresso-conica, late umbilicata; anfractibus $4\frac{1}{2}$, planiusculis, ad suturas angulatis, liris subconfertis transversis granulosis (interstitiis elevate et oblique striatis) instructis, anfractu ultimo cingula valde crenulata ad peripheriam ornato; apertura oblique quadrata; labio recto in medio late reflexo; labro prope suturam angulato, intus lævi; suturis canaliculatis; basi liris concentricis granulosis majoribus cum minoribus alternantibus ornata; umbilico lato, perspectivo, margine crenulato. Colore albido, maculis rufo-fuscis radiatim picto.

Hab. Off Mino-Sima, Straits of Korea; 63 fathoms.

This species is more depressed and more widely umbilicated than *E. Japonica*, and the whorls are rather concave at the upper part; the granular liræ are wider apart, and the oblique striæ of the interstices coarser.

Enida gemmulosa, A. Adams.

E. testa depresso-conica late umbilicali, suturis profunde canaliculatis; anfractibus rotundatis, seriebus transversis granulorum squamiformium confertorum ornatis, quinque in anfractu ultimo, anfractibus superne et prope suturas tenuiter plicatis; apertura rotundato-quadrangulari; labio in medio excavato et valde reflexo; labro margine crenato intus incrassato et sulcato, basi convexiuscula seriebus quatuor granorum squamiformium instructa; umbilico profundo, margine crenato.

Hab. Off Mino-Sima; dredged from 63 fathoms.

This granular species differs very much from the two last described, but partakes of all the characters of the genus. The scale-like granules arranged in transverse rows are very peculiar. The aperture is nearly circular, and beautifully nacreous and pearly within; otherwise this shell might by some be mistaken for a species of *Echinella*.

Genus Conradia, A. Adams.

Testa turbinata rimate umbilicata, spira elatiuscula; anfractibus convexis, valde et concentrice carinatis, interspatiis sculptis. Apertura circularis; labio simplici, rotundato; labro margine fimbriato aut dentato, intus lævi; rima umbilicali costa semilunari extus marginata.

In many particulars this genus resembles *Trichotropis*, but the aperture is circular and entire in front. In some respects it

approximates to *Isapis,* a genus founded by my brother and myself in our 'Genera of Recent Mollusca,' but it is without the plait in the middle of the inner lip. It has also relations with *Fossar;* but the aperture is not semicircular as in that genus, nor is the inner lip straight.

There appears to be a sufficient reason—in the possession of two frontal lobes between the tentacles by the last-mentioned genus *Fossar,* and in its habitat—to make it the nucleus of a family distinct from *Littorinidæ.* The genus *Isapis* will form a second member of *Fossaridæ,* and *Conradia* and the following genus *Couthouyia* will be also included in it.

Conradia cingulifera, A. Adams.

C. testa turbinata, rimata, pallide fusca; anfractibus $4\frac{1}{2}$, convexis cingulatis, anfractu ultimo cingulis septem transversis elevatis rotundatis, interstitiis longitudinaliter elevatim striatis cincto; labro margine dentato.

Hab. Off Mino-Sima; 63 fathoms.

Conradia carinifera, A. Adams.

C. testa turbinata, umbilicata, pallide fusca; anfractibus quatuor rotundatis, supremis lævibus, anfractu ultimo carinis quinque transversis lamellosis distantibus cincto, interstitiis longitudinaliter striatis; labro margine fimbriato.

Hab. Off Mino-Sima; 63 fathoms.

Conradia clathrata, A. Adams.

C. testa turbinata, sordide alba, anguste umbilicata; anfractibus $3\frac{1}{2}$, convexis, supremis cingulatis, ultimo liris elevatis transversis et costis obliquis longitudinalibus distantibus clathrato, interspatiis longitudinaliter elevatim striatis; apertura circulari; labro margine extus incrassato, intus lævi.

Hab. Straits of Korea; 63 fathoms.

Genus Couthouyia, A. Adams.

Testa ovata, profunde et late rimata; spira acuminata; anfractibus convexis, decussatis, anfractu ultimo ventricoso, suturis impressis. Apertura semi-ovata; labio recto, angusto, libero, antice dilatato; rima umbilicali elongata; labro simplici arcuato, margine acuto, integro.

Couthouyia decussata, A. Adams.

C. testa ovata rimata, tenui, sordide alba; anfractibus $4\frac{1}{2}$, rotundatis, lineis longitudinalibus et liris transversis, elevatis, decussatis; fissura umbilicali lira semilunari extus marginata.

Hab. Off Mina-Sima; dredged from 63 fathoms.

Lachesis Japonica, A. Adams.

L. testa valida, turrita, fusca; spira elata, aperturam superante; anfractibus novem, tribus supremis lævibus, alteris convexis, costis longitudinalibus validis et liris elevatis transversis regulariter cancellatis, interstitiis longitudinaliter striatis; apertura elongata, ovali, antice canali brevi vix recurva instructa; labio lævi, antice flexuoso; labro margine crenato, intus lirato.

Hab. Off Mino-Sima; 63 fathoms.

I believe this to be the finest and largest species of this little-known genus hitherto described. It is an elegant *Phos*-like shell, regularly cancellated, and with the spire as long again as the aperture. The three upper whorls are large, smooth, and nucleolar. It is an inhabitant of deep water.

Cancellaria (*Merica*) *Fischeri*, A. Adams.

C. testa ovato-conica, imperforata, pallide fusca; spira elata; anfractibus $5\frac{1}{2}$, planiusculis, longitudinaliter, nodoso-plicatis, transversim liratis; apertura oblonga, antice vix canaliculata et angulata; labio late flexuoso, margine externo libero, acuto, plicis tribus obliquis in medio instructo; labro effuso, intus lirato, margine acuto, integro.

Hab. Straits of Korea; 63 fathoms.

Trichotropis cedo-nulli, A. Adams.

T. testa turbinata, anguste umbilicata, fusca, spira elata; anfractibus $5\frac{1}{2}$, rotundatis, cingulis transversis crenatis, majoribus cum minoribus alternantibus, et costellis obliquis longitudinalibus eleganter clathratis, interstitiis concinne et pulcherrime decussatim sculptis; apertura semicirculari, antice canaliculata; labio recto, inferne callo parvo instructo; labro simplici, arcuato, intus lævi.

Hab. Off Mino-Sima; 63 fathoms.

This is a very beautifully sculptured species, with rounded whorls and semicircular aperture. If we separate the genus *Trichotropis* into three groups, as will doubtless be necessary before long, this species will belong to *Trichotropis* proper.

Velutina Pusio, A. Adams.

V. testa parva, pallide fusca, epidermide liris elevatiusculis radiantibus et lineis concentricis concinne decussata; spira prominula; anfractibus $1\frac{1}{2}$, convexis; apertura ampla, expansa; labio postice reflexo, antice acuto et simplici; labro effuso, margine arcuato, integro; regione umbilicali impresso.

Hab. Straits of Korea; 63 fathoms.

Rissoa (*Goniostoma*) *pupiformis*, A. Adams.

R. testa solida, alba, polita, vix rimata, pupiformi, utrinque constricta;

anfractibus $8\frac{1}{2}$, planulatis, lævibus, suturis impressis; apertura ovali; labio incrassato; labro flexuoso, in medio dilatato, extus marginato.

Hab. Off Mino-Sima; from 63 fathoms.

Skenea cornuella, A. Adams.

S. testa subdiscoidea, ovato-oblonga, tenui, corneo-fusca, late umbilicata, apice elato; anfractibus $3\frac{1}{2}$, rapide accrescentibus, rotundatis, ultimo ad peritrema soluto, striis incrementi conspicuis; apertura perobliqua, transversim ovata; peritremate continuo, acuto, integro, expanso.

Hab. Off Mino-Sima; Straits of Korea; 63 fathoms.

Corbula bifrons, A. Adams.

C. testa tumida, ovata; valva sinistra minore, inclusa, inæquilaterali, antice rotundata, postice subangulata, margine ventrali undulato; valva dextra magna, alba, convexa, concentrice lirata, liris confertis sæpe dichotomis, irregularibus, undulatis; valva sinistra parva, inclusa, lævi, tenuiter concentrice striata, lineis elevatis rufis radiantibus, circiter decem, ornata.

Hab. Straits of Korea, 63 fathoms; off Mino-Sima.

This is a very singular little species of *Corbula*, single valves of which are common, but perfect specimens rarely found. The two valves are entirely different in form, sculpture, and colour, and, unless met with *in situ*, would be mistaken for different species. The edge of the small valve is very thin, and bent up within the margin of the right or larger valve; and the radiating elevated lines are continued as far as the very extreme of the circumference.

Limopsis oblonga, A. Adams.

L. testa subtrigonali oblonga, obliqua, tumida, inæquilaterali, longiore quam latiore, latere antico rotundato, postico declivo; superficie valvarum concentrice lirata, liris crenulatis, inæqualibus, nonnullis validioribus; linea cardinis arcuata, area late triangulari; fossa magna profunda; margine ventrali intus sulcato-crenato.

Hab. Off Mino-Sima; 63 fathoms.

This species is unlike any hitherto described; it is in bad condition, though doubtless, when fresh, it is clothed with the same pilose epidermis as the other species. Other species of this genus, from this sea, are known to me; but I am unable to determine whether they are new.

Terebratella Mariæ, A. Adams.

T. testa gibba elongato-ovali, lævi, alba, nitida, minutissime punctata, lineis incrementi concentricis insculpta; valvis convexis, æqualibus,

marginibus integris; valva ventrali rostrata, rostro recurvo; foramine parvo, integro; deltidio inconspicuo; valva dorsali lævi, in medio simplici, non depressa aut sulcata.

The loop in this species is very broad and ribbon-shaped, and is doubly attached—to the hinge plate, and also in the centre by transverse processes. It is a handsome, white, smooth species, approaching most nearly to *T. Bouchardii* of Davidson.

The Micrographic Dictionary; a Guide to the Examination and Investigation of the Structure and Nature of Microscopic Objects. By J. W. Griffith, M.D., F.L.S. &c., Member of the Royal College of Physicians; and Arthur Henfrey, F.R.S., F.L.S. &c., Professor of Botany in King's College, London. London, John Van Voorst, 1859, 8vo.

Amongst the signs of the times in the scientific or pseudo-scientific world, we must reckon the appearance and rapid augmentation of an army of microscopists,—men who appear to set an especial value upon anything small, and to pride themselves particularly on the possession of an instrument which will exhibit these little things with tolerable distinctness. They don't particularly care about the structure of the objects, except so far as their microscopes can make it out: they delight in test-objects, and break out into ecstasies over a peculiarly difficult one, or rejoice with exceeding triumph on finding that their eighth will show a few lines or other markings better than somebody else's twelfth, and so on. These *savants* would appreciate an elephant for the sake of a hair from his tail, or a whale for a remarkably fine section of his baleen. For their delectation we have a Microscopic Society, which, instead of being, as its name implies, an exceedingly minute and insignificant body, is actually one of the most flourishing institutions of the day; and we sometimes hear the term "microscopic science" applied to the curious agglomeration of subjects which is supposed to be the study of the microscopists,—a term which certainly in many cases is more grammatically correct, as it would require no small penetrating and defining power to detect the science possessed by many of them. Nevertheless we cannot but feel a considerable sympathy even with the most *dilettante* of microscopic observers. At the very least, they are pursuing a harmless amusement; and if they fancy that they are at the same time engaged in the study of science, who can quarrel with the innocent delusion? Which of us would care to be taken precisely at his neighbour's valuation? Moreover, it is from the ranks of the *dilettanti* that the great scientific army of martyrs is for the most part recruited; and the microscopists in particular deserve our thanks for the many improvements which they have made directly or indirectly in the means of microscopic observation. It is for them that the most ingenious mechanics have laboured unceasingly in bringing the microscope and its adjuncts to an almost incredible

degree of perfection; it is their money that pays the expense of costly experiments; and it is mainly owing to the great demand created by them for microscopes and their accessories, that the scientific man can now procure a good instrument at a moderate price.

Amongst the more striking immediate results of the springing up amongst us of this sect of "minute philosophers," as our forefathers would have termed them, we must reckon the production of an extensive and daily increasing literature, intended to guide the possessor of a microscope in the proper use of the means of investigation in his hand. A small portion of this literature has undoubtedly been contributed by the microscopists themselves (as indeed in some cases is but too evident); but the best works are all the productions of men already holding a high place as naturalists,—such as Quekett, Carpenter, Gosse, and others.

The largest and most important of all the works above alluded to is undoubtedly the 'Micrographic Dictionary' of Griffith and Henfrey, of which a second edition is now before us, the first edition having been published only at the end of 1855. In this book the authors have endeavoured to bring together all the scattered information of which the microscopic observer stands so much in need. In the "Introduction" we have a description of the structure of the microscope and the mode of using it, together with brief general directions as to the most valuable accessory apparatus, both for the collection and display of microscopic objects, followed by a most valuable dissertation on the method of microscopic analysis. In the body of the work, which is arranged alphabetically, we find further special reference to these practical parts of the subject—such as the mode of employment of polarized light, chemical reagents, &c., in microscopic research,—and also to the various methods to be adopted and materials to be used in the preparation and preservation of objects. But the great bulk of the volume is devoted to the consideration of the various classes of microscopic objects, indicating not only the mode of procuring, observing, and preparing them, but describing admirably the chief points in their structure, physiology, and habits. Of the higher animals, the minute anatomy and physiology of the principal elementary parts and organs are described. Thus, we have articles on 'Bone,' 'Cartilage,' 'Hair,' 'Feathers,' 'Teeth,' &c., in which the structure and mode of formation of these parts are briefly explained; and in the same way the structure and functions of the 'Liver,' 'Lungs,' 'Kidneys,' and other organs of the animal body are described.

The whole of these histological articles are copiously illustrated with woodcuts, many of which are copies of the admirable illustrations of Kölliker's 'Microscopic Anatomy.' In other articles we find special reference to certain points in the physiology of plants and animals; and the minute anatomy of the higher plants is also carefully described. The remainder of the articles are for the most part devoted to the special description of the various groups of animals and plants which may be regarded as possessing most interest

for the microscopist; the classes, orders, families, and genera of the lower sections of both kingdoms are characterized; their leading peculiarities, both of structure and habits, are pointed out, and even a considerable number of species are described.

It may be thought that a systematic treatment of this part of the subject would have been preferable; but for many reasons we are inclined to think that the authors have exercised a sound discretion in adhering to the Dictionary form throughout. Such a work as this is obviously not to be regarded as presenting its readers with a complete system of nature; many departments of the system only require to be touched upon, or to be treated in a very different way to others: this may be done with great propriety in a Dictionary, whilst the same mode of treatment in a systematic form would give rise to irregularities and an apparent patchiness in the book, which could not but have been distasteful to a critical eye. Moreover, the alphabetical arrangement is of great advantage to those commencing and carrying on a discursive study of the whole range of natural history, such as is usually cultivated by the true microscopist; for they not unfrequently obtain an object and its name at the same time, when by means of this Dictionary they may easily learn something of the structure and properties of their acquisition. On the other hand, by the arrangement which has been carefully followed throughout by the authors, by which the groups included in each superior group are briefly referred to under the latter and more fully in their proper place in the alphabetical series, it is easy for any one to work out any of the forms of animals and plants mentioned in the volume, especially as this process is greatly assisted by a copious series of cross-references; and any one desirous of obtaining further information upon any point has the means of so doing placed within his reach by the excellent bibliographical references appended to each article. These bibliographical memoranda are indeed of the highest importance, and will render the 'Micrographic Dictionary' a valuable handbook even for the advanced student of nature, to whom, moreover, the having such a vast mass of scattered zoological and botanical knowledge brought together within the compass of a single volume cannot but be exceedingly convenient.

The preceding remarks upon the scope and plan of this work apply equally both to the first and second editions, and we have still to indicate in what respects the latter differs from its predecessor. And this second edition comes to us with a sort of melancholy feeling, as the last work to which one of its distinguished authors set his hand; the press proofs of the last three sheets were only waiting for his finishing touch, when the hand of death fell suddenly and prematurely upon Professor Henfrey, in the midst of his indefatigable labours. The portion of this volume which we may consider as falling more particularly under the care of this amiable and lamented botanist has required comparatively little alteration. In regard to the general structure and classification of plants, little change has taken place within the last few years; and accordingly the botanical articles remain much as they were. Nevertheless we find abundant

evidence of the pains-taking labour of their late author in those alterations which have been made in many of them, with the view of introducing those new facts in the structure and physiology of plants which have been brought to light since the publication of the first edition. In fact, these articles furnish a most admirable guide both to the general anatomy and physiology of plants, and to the classification and nomenclature of the lower forms of the vegetable kingdom.

In the zoological articles, on the other hand, we find a vast improvement. Systematic zoology has been for some time in a transition state; and it will probably be many years before we again sit down quietly at the feet of a new Cuvier. In the first edition of this work, the zoological editor, perhaps from a desire to avoid adopting views of too advanced a nature, certainly placed himself rather behind his age; but in the new edition this is all changed, and the scheme of classification given in the article 'Animal Kingdom,' and followed throughout the work, may be looked upon as a very good *conservative* zoological system. The influence of this change upon the distinct articles is of course very great; many of them have been completely remodelled, and a great quantity of new articles have been introduced, principally in connexion with the Foraminifera, Acari, Polyzoa, and Tunicata. To other articles important additions have been made; and the enormous mass of materials here brought together is now presented to the student in a most convenient form.

Besides the articles on natural-history subjects, there are several on diseases and morbid products of the animal system, in the investigation of which the microscope comes into play; and in the present edition we notice that the microscopic detection of adulterations has received a considerable share of attention.

We had observed a few slight errors and omissions in some of the articles, to which we might have called attention; but this notice has already extended to such a length, that we cannot, in justice to our readers, do otherwise than pass over them in silence, more especially as they are not of a nature to detract from the general excellence of the book, being in fact rather *lapsus pennæ* than grave faults. But we cannot conclude without calling attention to the almost innumerable figures, many of them coloured, contained in the plates appended to the volume, which have been executed in the most beautiful manner by Mr. Tuffen West. These plates, of which there are no less than forty-five (four new ones having been added to this edition), contain magnified representations of an immense number of objects,—the wonder often being how such an amount of details could have been crammed into the space; and every figure is accompanied by a number indicating the magnifying power under which the object is supposed to be seen,—a point of the highest importance, for the want of which many expensive plates are often of comparatively small value. Taking the number and quality of these plates into consideration, we have no hesitation in saying that the 'Micrographic Dictionary' is not only a very good book, but also a very cheap one.

The Ibis, a Magazine of general Ornithology. Edited by Philip Lutley Sclater, M.A. Vol. I. Trübner and Co., 1859.

The taste for Ornithology naturally arises from the sporting instincts of an Englishman. It is the love of shooting developed in a scientific direction. Nor could there easily be mentioned any other pursuit which combines in itself so many advantages as does a love of Birds and of Bird Lore, whether as a serious study or as a healthful and instructive recreation.

The geologist justly boasts his familiarity with mountain-climbing and with mountain scenery—the wide range of his studies—his broad views of science; yet the study of birds is more inviting still, as it springs more instinctively, and there is a charm in living Nature far beyond the delight in stones. And surely their prizes are well won by those who have braved alike the sun of Africa, or snows of Lapland, or pestilent tropic marsh.

No wonder that the Bird-men of England should claim a journal of their own. Entomologists have long enjoyed the privilege; and when the scarcely more numerous class of Botanists have several publications, it has always been a matter of surprise to us that the Ornithologists had none.

Therefore it was with no small pleasure that we hailed the birth of the 'Ibis.' We have watched its progress with much interest; and now that the results of the first year are before us, we must say that the new journal is very creditable to the contributors, besides being a really valuable accession to scientific literature.

It is to the enterprise of a club or fraternal union of zealous young Cantabs that we owe the 'Ibis.' Among the well-known names which we recognize, not the least is that of poor John Wolley, whose graphic delineations of the habits and haunts of his favourites must be fresh in the memory of all English lovers of birds. A sad blow is his early death to the little band who first projected the undertaking; as great a loss to those who have always followed his pen with so much delight. But there is no want of writers when we find contributions from so many different countries, all showing no mean zeal and care in observation. The high names of Sclater, Knox, Eyton, Hewitson, Newton, Gurney, Salvin, Tristram, &c., bring their reputation to the new magazine; while those who have their spurs yet to win seem determined not to be left behind in the race.

It has been objected in certain quarters that there was no need of an 'Ibis.' In answer to this we would simply ask, where could such a collection of papers have found room? Again, would they ever have been written at all?—would the expeditions narrated have been undertaken without some such stimulus and bond of fraternity?

It is true that the cultivators of foreign Ornithology are few in number. But it does not appear that the 'Ibis' can be considered wanting in interest to the purely "British" Ornithologist who only knows 'Yarrell's British Birds.' Surely such a one may with

much advantage trace the so-called "British" species to their winter retreats, or compare their habits in other lands with what has been noticed in our own. Imperfect indeed must be our acquaintance with any bird of whose existence we only know that "a specimen was once captured at York," and another "shot near Yarmouth," yet fondly counted a British bird because it has once or twice (much to its own grief) set foot upon our free soil. We wonder whether such a construction would admit the Wandering Jew to the full rights of a British subject.

No; we must never cease to follow the wandering feathered tribes, whether they go south, or east, or north. They must be put under "surveillance," traced home to their domicile, their diet ascertained, their children counted, their cottages and cradles overhauled, and an exact photograph taken on the spot. Reader, if you turn to one of poor Wolley's "photographs," such as that of the Crane in Lapland (given at p. 191), &c., you will see what we mean.

But, to speak of the more strictly scientific features of the work, it is the evident and most praiseworthy endeavour of the worshippers of the Sacred Ibis to keep up thoroughly with their subject. No pains are spared to obtain and make public the most recent observations of their Continental brethren; and we would fain hope our young 'Ibis' may bear comparison with any similar publication of its own class abroad.

It would be invidious to challenge comparison between the respective articles, where it has been the effort of all to contribute to the common weal; and we must say we think much has already been done under the able superintendence of the editor, whose name is not unknown to the readers of the 'Annals.'

After what has been said, we hope that a short analysis of the contents may suffice.

The first volume of 'The Ibis' contains articles upon the birds of the following countries:—

Central America (Sclater and Salvin), I. XII. XXIII.
St. Croix, West Indies (A. & E. Newton), VI. XIII. XXV.
Ecuador, Humming Birds (Jameson and Fraser), XLI.
Mexico, Tyrannidæ (Sclater), XLIV.

And as regards our own hemisphere, the observations relate to—

Southern Palestine (Tristram), II.
Egypt (E. C. Taylor), III.
Western Africa (Ibadan), (J. H. Gurney). XV.
Northern Africa (Tristram), V. XVI. XXIX. XLIII.
Western Spitzbergen (Evans and Sturge), XVIII.
Eastern Atlas (Salvin), XIX. XXX. XXXIV.
South-east Africa (J. H. Gurney), XXIV.
The Red Sea (Heuglin & Hartlaub), XXXIII.
Beyrout (J. H. Gurney), XXXVII.

Besides their value in a general point of view, as contributing to our knowledge of the range and economy of the species, many of these chapters contain information of high interest respecting British birds.

For instance, more than half of those noticed by Mr. E. C. Taylor in Egypt, and nearly one-half of the species observed by Mr. Tristram in Palestine, belong to the British list. Out of 357 birds found in Algeria, only fourteen have not been observed in Europe. North Africa and the Great Desert seem to be the regular winter-quarters of our familiar summer visitants. In the "oases" (p. 278), the "Willow-wrens and White-throats hop on every twig, beneath the shadow of the never-failing palm,—peaceful retreats, rarely visited by any Raptor more formidable than the Kestrel." There is a paragraph in Mr. Tristram's introductory paper (p. 157) which we must not pass without notice. Unless we have misapprehended his meaning, he seems to look upon the Bird-fauna as showing more clearly than any other class the relationship of the productions of Algeria with those of Europe. At the same time, the writer expresses his surprise that the differences are greater *specifically* when we turn to the Reptiles and Mammifers; whereas the Flora presents a striking resemblance *generically*. Now, considering that so large a proportion of the species of Birds common to both shores of the Mediterranean are migratory, would it not be safer to strike off upon both sides all the "locomotive" kinds, and then contrast the species *which nest* upon either side? Thus might the features of the Algerian "Avi-fauna" be found to correspond more nearly to those of the other classes.

To Mr. Salvin's explorations in Eastern Atlas, the same interest attaches in a British point of view; and to both we are indebted for most interesting particulars as to the breeding-haunts and habits of many birds little known in this country. The same may be said of the observations made in Spitzbergen; for, although the number of species found there was very small compared with Africa, few of them nest in Britain, though nearly all visit us.

If an Englishman is less concerned with the birds of St. Croix, it is no fault of the writers, who have treated their subject in a most pleasant and readable fashion. We can only regret that our acquaintance with the West Indian species is so limited. Still here is the *Belted Kingfisher*, a winter visitant to St. Croix, living in the Mangrove swamps, and sometimes venturing half a mile to sea in quest of fish: it seems to feed upon small crabs as well. One was seen far out at sea, flying round the steamer, in lat. 26° 17′ N., long. 57° 28′ W., in October.

The *Yellow-billed Cuckoo* breeds in St. Croix. As is well known, this bird incubates its own eggs. Mr. Newton describes these Cuckoos as remarkably tame, and affectionate to their mates.

The *Virginian Quail* has been successfully naturalized in the island. Though reputed a British bird, our climate is probably unsuitable, as the authors inform us all attempts to establish it in the eastern counties of England have failed. *Wilson's Stint*, the *Pectoral Sandpiper, Sooty Tern, Laughing Gull*, and a *Petrel* or two, complete the names which occur in Yarrell. The eggs of eight species are admirably figured by the masterly hand of Hewitson.

It is indeed of high importance to the right understanding of geographical distribution, and especially of migration, that we should

have a series of trustworthy notes from whatever countries are inhabited or traversed by the migratory tribes. We feel sure of this that migration is far more universal among birds than is generally supposed. Mr. A. E. Knox has already done good service by calling attention to this, as well as by his own excellent observations. It is to be hoped that no English Ornithologist will think his time and pains ill bestowed upon a subject so promising and so inexhaustible. Too little is known of the *direction* taken by the various migrants; often in spring, they appear to follow quite a different route to that of the autumn. How are they affected by prevailing winds?—by clear or foggy weather? How long are they on their way? At how many stages do they linger?—and are they much or little delayed by changes of temperature, when they have once set out? All these are most interesting points; and we trust some light may eventually be thrown upon these questions as the number of observers becomes every year increased.

Mr. Tristram, worthily following the example set by Mr. Wolley, has been the discoverer of the native haunts and nests of several birds whose eggs were previously little or not at all known.

The study of eggs is one essential to the Ornithologist. It is too true that instances are not wanting of collectors who are content to possess the eggs as so many pretty objects, hardly knowing anything of the birds themselves; and no little mischief has been done in this way by the stimulus given to the extirpation of rare species. But the scientific student is compelled to commence his investigations "ab ovo," and thus he is led to detect the really native haunts of his birds. There are, in the present volume, two excellent chapters bearing upon the study of eggs,—one by the veteran Hewitson, the other a review of two recent works upon American and German Oology. As usual with the German writers, we find Herr Bädeker too much inclined to found new species upon slight differences, and fortifying himself in this by the inverted system of reasoning from egg to bird, instead of from bird to egg (p. 404). It occurs to us that the terms "European" and "British" are somewhat too loosely applied to eggs when they belong to birds which, it is true, must be included in the respctive Faunas of Europe and Britain, but whose eggs there is no reason to expect we shall ever find upon European or British soil. In what sense the egg of the American White-winged Crossbill can be called "British," it has always puzzled us to discover, though it is very likely the Americans may have some day to thank an Ibis-worshipper for leading him to its "cunabula."

When we read that the Knot and Sanderling, so well known upon our shores, have hitherto baffled the utmost pursuit of their nests, when we hear that at the North-east Cape, in latitude 78° N., these birds were still pressing onwards, we are almost compelled to ask with the writer may there not be some circumpolar land (or islands) unvisited as yet, except by these adventurous Sand-pipers? At the same time, we think too much stress should not be laid upon the negative evidence of one observer, posted upon an isolated point of that vast region, whether his station was unfavourable from its

physical features, or whether we may suppose the birds migrating along the parallels of latitude.

Separate chapters are devoted to the breeding of the Smew and Crane (Wolley); Nesting-places of the Frigate Bird (G. C. Taylor); Harlequin Duck (a critical article, by A. Newton); Nesting of Black Woodpecker (W. H. Simpson); Nesting of Eagle Owl in Captivity (Edward Fountain); White's Thrush as observed in Warwickshire (R. F. Tomes); Black-winged Stilt in Sussex (A. E. Knox); Breeding of Mutton Bird (*Puffinus obscurus*) (R. Elwes); Pel's Owl (J. H. Gurney): all interesting and very readable articles.

Under the head of the "general subject" may be quoted a paper on the Preparation of Birds' Skeletons, by Mr. Eyton; Mr. Tomes on the genera *Oreocincla, Turdus,* and *Merula,* and Mr. Wallace's remarks upon the Geographical Distribution of Birds, which those who are interested in the subject will do well to compare with Mr. Sclater's in the 'Journal of the Proceedings of the Linnæan Society' (vol. ii. p. 13), as well as with some of the remarks preliminary to different articles in the 'Ibis.'

The new species of Birds described in this volume amount to some twenty. We could wish to see them collected into a separate appendix at the end of each year.

There are given fifteen beautifully coloured plates to illustrate this volume: three of these, representing eggs, are from the pencil of Hewitson; others of the drawings are by J. Wolf,—sufficient guarantee that everything has in this respect been done to give the new periodical a high character. Photography appears to have been successfully employed by Dr. Brewer in copying the exact markings of eggs.

Each Number concludes with a summary of recent Ornithological publications, English and Foreign, a few paragraphs of short notices, extracts from correspondence, &c. If anything be still wanting when so much has been accomplished, we could wish to see the 'Ibis' becoming the registrar of the more important observations made upon British birds upon our own soil: but we are convinced that it is only needful for the Journal to become better known to ensure this result.

We may now conclude our pleasant task by heartily recommending the 'Ibis' to every one who takes any interest in birds, whether British or foreign, and with the hope that its circulation among the fraternity may soon double the number of accurate and diligent observers. He who would be a true Ornither must have no delight in ease or in mere shooting. He should be a kind of scientific Gipsy: a brown-faced, hardy, out-o'-doors man; a quick shot; a dauntless climber; an earnest student; a practical bird-stuffer, with a dash of the author: and if to this is added a warm feeling for the beauties of Nature in all her forms, we envy the man who is such, and we commend him especially to the worshippers of the Ibis as a worthy fellow-craftsman. Such, we know, are many Englishmen, and we trust their numbers may be ever on the increase.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Jan. 25, 1859.—E. W. H. Holdsworth, Esq., F.L.S., in the Chair.

Descriptions of New Species of the American Family Tyrannidæ. By Philip Lutley Sclater.

Attila citriniventris.

Rufescens, capite obscuriore et cinereo tincto, dorso imo dilutiore, uropygio citrino-flavo : alis nigricantibus, extus rufescente limbatis ; gula cinerascente, pectore rufo, ventre cum crisso citrino-flavo, hypochondriis et tectricibus subalaribus rufis : cauda clare rufa unicolore, basin versus dilutiore : rostro nigricante, pedibus plumbeis.

Long. tota 6·75, alæ 3·2, caudæ 2·6, rostri a rictu 1·0.

Hab. In valle Amazonum superiore ad ripas fl. Ucayali (*Hauxwell*).

This species of *Attila* comes nearest to *Attila spadiceus* of Cayenne and Northern Brazil, and is of about the same size, but may be distinguished by its darker and more cinereous head and yellow belly, as well as minor differences. An example in my own collection was received from MM. Verreaux of Paris. One belonging to Mr. Gould was procured by Hauxwell on the Ucayali.

As to the position of this genus of birds and the synonymy of the species, I agree with the views of M. de Lafresnaye, as given in his article in the 'Revue Zoologique' (1848, p. 39).

Next to *Attila*, I think, must be placed the curious type *Casiornis* of Bonaparte, of which the earliest specific name appears to be *rubra* of Vieillot. Its synonymy is very much confused ; but I am inclined to refer *Suiriri roxa*, Azar. sp. 188 ; *Muscicapa rubra*, Vieill. Dict. xxi. 457, et Enc. p. 831 ; *Muscicapa hæmatodes*, Licht. ; *Dasycephala hæmatodes*, Cab. in Wiegm. Arch. 1847, i. p. 222 ; *Dasycephala rubra*, Burm. Syst. Ueb. iii. 87 ; *Tyrannula rufula*, Hartl. Rev. Zool. 1852, p. 6, and, probably, *Tyrannus thamnophiloides* of D'Orbigny (Voy. p. 309), to this bird. MM. de Castelnau and Deville obtained examples of it at Goyaz during their American travels ; and it has recently been described and figured by M. Des Murs in the Ornithology of their Expedition under the name *Casiornis typus*. Its general structure is very much that of *Attila* ; but the bill is quite short and much more feeble, and the feet are not nearly so strong.

Myiodynastes nobilis.

Supra ochracescenti-rufus, nigro variegatus ; plumis medialiter nigris, ochracescenti-rufo undique marginatis : crista brevi verticali interne aurea : loris et macula post-oculari cum striga rictali nigris : fronte et linea superciliari flavicantibus : alis nigricantibus ; tectricibus ochracescenti-rufo, secundariis albo, primariis rufo extus limbatis : cauda ferruginea, rectricum omnium parte mediali, scapam marginante, nigra : subtus albus,

abdomine et crisso citrino indutis, pectore et lateribus nigro flammulatis: subalaribus citrino-flavis: rostro corneo, mandibulæ inferioris basi alba; pedibus nigris.

Long. tota 8·5, alæ 4·5, caudæ 3·7, rostri a rictu 1·2, tarsi 0·74.

Hab. In litt. reipublicæ Nov. Granadæ in vicinitate urbis S. Marthæ.

This fine *Myiodynastes* is a close ally of *M. audax* and *M. luteiventris*, but is readily distinguishable by its stronger bill, longer tail, which is slightly forked, and the lighter surface of the body below; this is nearly pure white on the throat and middle of the belly, being rather sparingly flammulated on the breast and sides, which latter parts, along with the crissum, are tinged with yellow.

The example of this bird in my own collection was obtained from MM. Verreaux of Paris, and was received from their collector at Santa Martha.

The true type of the genus *Myiodynastes*, Bp. (a generic term published by the Prince, like many others, without characters, or even the indication of any exact type), was intended, I believe, to have been the *Tyrannus audax*, Auct. The name first appeared in print in the 'Comptes Rendus' for April 3, 1854, in connexion with *M. luteiventris*; but it also occurs in the catalogue of birds collected in Cayenne by M. Desplanches* (p. 11), where it is applied to *T. audax*. The division seems a natural one, connecting *Pitangus* and *Tyrannus*.

Contopus mesoleucus.

Obscure cineraceus, olivaceo vix tinctus, pileo, alis et cauda nigricantibus, secundariis dorso proximis albo extus marginatis: subtus obscure cineraceus, vitta longitudinali a mento corpus descendente cum ventre toto albo, flavicante tincto, hypochondriis et crisso cineraceo adumbratis: fasciculo plumarum utrinque ad latera uropygii, alis obtecto, albo: rostro nigro, mandibulæ inferioris basi flavida: pedibus nigris.

Long. tota 6·75, alæ 4·0, caudæ 2·7.

Hab. In Mexico meridionali, et in rep. Guatemala (*Skinner*).

This bird is easily recognizable by the creamy-white medial line, which passes from the chin to the crissum, expanding greatly on the belly. My examples are from Orizaba, collected by Botteri. Mr. Gould possesses a specimen from Guatemala of the same species. The form is quite typical,—the wings being very long, and the second primary, which is the longest, considerably (by 0·15 inch) exceeding the first and third, which are equal. The curious white tufts at the side of the uropygium, covered by the wings, are very noticeable in this species—more so than in my examples of *C. borealis*.

* This little tract is extracted, I believe, from the Mémoires of a learned Society, published at Caen. The only copy I have ever seen was given to me by the author himself in 1857, shortly before his death. In it is established a new genus of *Tyrannidæ—Planchesia—*for *Muscicapa fuliginosa*, Gm. (Pl. Enl. 574. fig. 1); and the generic term *Syrichtha*, the type of which appears to have been unknown to Mr. Gray, is used for *Tyrannus curtipes*, Sw.

Contopus sordidulus.

Obscure cineraceus, tectricum majorum et secundariorum marginibus dilutioribus, fere albicantibus: loris albidis: subtus pallide cinereus, gutture medio albescente, ventre medio et crisso albis: rostri nigri basi inferiore pallida: pedibus nigris.

Long. tota 6·0, alæ 3·2, caudæ 2·5.

Hab. In Mexico meridionali et Guatemala.

This *Contopus* much resembles the preceding, but is considerably smaller in its dimensions, of a rather purer cinereous above, and much lighter cinereous below. This colour passes into whitish on the throat, and nearly pure white on the belly and crissum, without showing the continuous white medial stripe, which renders *Contopus mesoleucus* so noticeable. In structure it is identical with *Contopus virens*; but it has no trace of olive on its plumage.

I regard *Contopus* as a very natural division of the *Tyrannidæ*, characterized by its long wings and short tarsi.

Near *Contopus*, must be placed, I think, Prince Bonaparte's genus *Planchesia*, referred to above.

February 22, 1859.—Dr. Gray, F.R.S., V.P., in the Chair.

On the Eared Seal of the Cape of Good Hope (Otaria Delalandii). By Dr. J. E. Gray, F.R.S., V.P.Z.S.

At a preceding meeting*, I gave an account of the Eared Seal from Behring's Straits, showing that it was distinct from the species found in other localities. I have since received from Paris a fine specimen of an adult Eared Seal from the Cape of Good Hope, which has been described in the Catalogue as *Phoca*, or *Otaria Delalandii*. Like the Seal from Behring's Straits, it proves to be a species of *Arctocephalus*, and, like it, is quite distinct from any of the species of that genus in the British Museum, being well characterized by the form and structure of the skull.

It is, like the Behring's Straits Seal, a *Fur-Seal*; that is to say, it has a close coat of red under-fur at the roots of the rigid flattened hair; but this under-fur is much shorter and less abundant in the adult specimen now under examination than in the adult specimen of the Eared Fur-Seal from Behring's Straits, or in the Eared Fur-Seal of the Falkland Islands. The Adult is about the same size as the Seal from the Arctic Circle, but is much paler in its general colour.

Arctocephalus Delalandii.

Hair rigid, under-fur small in quantity, reddish-brown; the hinder part of the palate with a deep narrow cavity, acutely angular in front.

Junior?

Le petit phoque, Buffon, Hist. Nat. xiii. 341, t. 53.
Little Seal, Penn. Quad. 243, from Buffon.
Phoca parva, Bodd. Elench. 78, from Buffon.
Phoca pusilla, Schreb. Säugeth. 314, t. 85, from Buffon.

* 'Annals' for January, 1860, p. 63.

Otaria pusilla, Desm. N. Dict. xxv. 600.

Otaria Peronii, Desm. Mamm. 250, 382; Encyc. Méthod. t. 111. f. 2, from Buffon.

Loup-marin, Pagès, Voy. aut. du Monde, ii. 32.

Adult.

Otaria Delalandii, F. Cuvier, Dict. Sci. Nat. xxxix. 423; Cuvier, Oss. Foss. v. 220, t. 18. f. 15, skull.

Phoca pusilla, part, Fischer, Syn. Mamm. 232.

Hab. Cape of Good Hope.

Cuvier (Oss. Foss. v. 220) observes that Delalande brought from the Cape a young specimen 3 feet 6 inches long, of a reddish-grey colour, the ends of the hairs annulated with grey and blackish, rather paler beneath—the whiskers strong, simple, and black—the feet black—the under-fur soft, woolly,—and two skeletons of young, and the skull of an adult specimen. This skull is figured (Cuvier, Oss. Foss. v. t. 18. f. 5); but unfortunately, the palate, which is the most characteristic part of the skull, is not figured nor described. The palate of the skull of the younger specimen is described thus:—"Le palais est plus étroit, se porte plus en arrière et est échancré par un angle plus aigu."

Buffon notices a young Seal, which he calls the *petit phoque* (vol. xiii. t. 53), on which the *Phoca pusilla* of Schreber and succeeding authors has been founded, which is probably the young of this species.

Daubenton states (Hist. Nat. xiii. 413) that the specimen figured by Buffon came from India; but it is probable that it was brought from the Cape of Good Hope in a ship coming from India. No Seal has as yet been described as inhabiting the coast of India.

Fischer confounded with *Phoca pusilla* of Buffon a Seal from Rottennest Island, on the eastern coast of Australia (Syn. Mamm. 232).

As the British Museum has a good series of skulls of this genus, I am induced to add the following synopsis of the species, characterized by the peculiarities of the skull alone.

I. *Face of skull short. Forehead convex, regularly rounded from the end of the nasal bone to the middle of the vertex. Lower jaw short, thick.*

ARCTOCEPHALUS URSINUS.

Arctocephalus ursinus, Gray, Cat. Phocidæ B.M. 41; et P. Z. S., *anteà*, p. 64.

Palate rather concave in front, narrowed and flattened behind, with a deep narrow hinder aperture, which has a regular ovate front edge; outer upper cutting-teeth moderate; orbit very large; zygoma very strong; grinders small.

Hab. Behring's Straits.

A skull of the adult male specimen here described.

II. *Face of skull moderately elongated. Forehead rather convex, slightly rounded from nasal bone to vertex. Lower jaw elongated, slender.*

Arctocephalus Hookeri.

Arctocephalus Hookeri, Gray, *l. c.* p. 45 ; Voy. Erebus and Terror, t. skull.

Palate deeply concave in front, narrow and rather concave behind, with a deep hinder aperture, which has a transverse truncated front edge with a slight central lobe directed backward; outer upper cutting-teeth very large, conical, acute; orbit moderate; zygoma slender; angle of jaw bent inwards.

Hab. Falkland Islands (and Cape Horn ?).

The skull of four half-grown specimens. They are all very uniform in their characters.

We have also the skull of a very young Seal which appears to belong to the same species.

In three of the skulls the outer upper cutting-teeth are very large and acute, more than half the size of the canines, and like them in form. In one skull (perhaps of a female ?) the upper outer canines are much smaller and more slender, not half the size of the same teeth in the other skulls of the same size, and the canines themselves are also much more slender; the front of the palate is also more concave.

III. *Face of skull moderately elongated ; forehead flattened from nasal bone to the vertex. Lower jaw rather short, strong.*

Arctocephalus Delalandii.

Otaria Delalandii, F. Cuvier.

Face rather short; palate concave, hinder aperture narrow, with a rather acute ovate anterior edge; teeth large; lower jaw short, strong.

Hab. Cape of Good Hope.

Two skulls of adults from the Cape; and one half-grown, the habitat being unknown. These skulls agree in the form of the hinder palatine opening, but vary in other respects a little from each other: the two adult ones differ in the aperture of one being wider and shorter than that of the other; in the young skull the front edge of the aperture is more acute in the centre than in either of the others; the outer cutting-teeth of the upper jaw are large, but much smaller than the very large canines.

Arctocephalus nigrescens.

Arctocephalus nigrescens, Gray, Zool. Erebus and Terror, t. . f. , skull (inedit.).

Face rather elongate. Palate slightly concave, flat behind, hinder aperture narrow, with a nearly straight front edge.

Hab. Falkland Islands?

A single skull from a half-grown specimen.

This skull is very like that of *A. Delalandii*, but differs considerably in the form of the front edge of the hinder palatine aperture: the outer cutting-teeth and the canines are moderately slender, and similar in form; but the latter are much the larger.

Arctocephalus lobatus.

Arctocephalus lobatus, Gray, Cat. Phocidæ B.M. p. 44.

Face moderately elongate; palate deeply concave, narrowed behind, hinder aperture with a semicircular front edge; lower jaw rather short, strong.

Hab. Australia, Port Essington. Houtman's Abrolhos.

The canines are very large and strong; the outer upper cutting-teeth are large and compressed.

Arctocephalus Gillespii.

Otaria Gillespii, Macbain, Rep. Phys. Soc. Edinb. 1858.

The face much elongated; palate slightly concave, front edge of the hinder aperture ovate; lower jaw elongate, strong.

Hab. California.

We have a cast of the original skull described by Dr. Macbain, now in the Museum of the College of Surgeons, Edinburgh.

The species is at once known by the length of the face: that is, in all the other skulls of the genus we have, a line drawn across the palate at the front edge of the zygomatic arch leaves one-third of the palate behind the line, and two-thirds in front of it; while in this species it leaves only one-fourth behind, and very nearly three-fourths in front of the line.

The skull has only four grinders on each side in the upper jaw, but one has evidently fallen out in front of the series and one behind; but the fifth grinder of the complete series, which is usually in a line with the front edge of the zygomatic opening, is in this species rather in front of it.

The Eared Seals (*Arctocephali*) have been divided into Fur- and Hair- (Eared) Seals by the sealers. *A. Hookeri* and *A. lobatus* are called Hair Seals, because they are destitute of any under fur: but this appears to be the case only with the older specimens; for the young of *A. lobatus* is said to be covered with soft fur, which falls off when the next coat of hair is developed. The under-fur is well developed in the adult specimens of *A. ursinus* and *A. Delalandii* and the half-grown specimen of *A. nigrescens*, and entirely absent in the adult *A. Hookeri* and half-grown *A. lobatus* in the Museum Collection.

April 12, 1859.—Professor Busk, F.R.S., in the Chair.

Descriptions of New Species of Birds collected by Mr. Louis Fraser at Pallatanga, Ecuador. By Philip Lutley Sclater.

Vireo Josephæ.

Fuscescenti-olivaceus, pileo nigricanti-fusco: alis caudaque intus

nigricantibus, extus olivaceo limbatis; superciliis distinctis albis; lateribus capitis cinereis: subtus albus, abdomine toto et tectricibus subalaribus flavo perfusis: rostro superiore plumbeo, inferiore albicante, pedibus plumbeis.

Long. tota 4·75, alæ 2·6, caudæ 1·8.

Seven ex. ♂ and ♀. The ♂s brighter below. "Irides dark hazel; contents of stomach, insects."

This is the only *Vireo* with a first spurious primary (in this bird measuring 0·7 inch from its insertion) which I have yet seen from Southern America. In form it is somewhat similar to *V. noveboracensis.* I have named it at Mr. Fraser's request after Señora Josefa Borja y Davilos, who, with other members of the same family, rendered every facility to Mr. Fraser in forming his collections on their estates at Pallatanga. The only other species of this group of which I have seen S. American examples are *Vireosylvia olivacea* of the U.S., which extends into New Granada, and *V. agilis* (*Lanius agilis,* Licht.) from Brazil, and extending northwards to New Granada. I do not know *Vireosylvia frenata* of DuBus (Bull. Ac. Brux. xxii. p. 150), said to be from Ocaña in New Granada; but the description given agrees with *Vireo altiloquus* of the Antilles.

NEMOSIA ORNATA.

Fuscescenti-cinerea olivaceo tincta; capite toto undique et corpore subtus saturate cinnamomeo-rufis; gula flavicantiore; ventre medio albo: rostro superiore nigro, inferiore cum pedibus plumbeis.

Long. tota 4·7, alæ 2·4, caudæ 2·0.

Three ex. "Bill black above, blue below; feet and legs blue: stomach contained insects." This pretty new species of *Nemosia* is a close ally of *N. sordida* and *N. ruficeps* of my Synopsis, but is conspicuously different in colouring.

ANABATES SUBALARIS.

Fusco-brunneus: uropygio et cauda tota saturate ferrugineis: striis capitis et colli superioris, plumarum scapas occupantibus, cum gula tota et striis pectoris latioribus pallide cervinis: tectricibus subalaribus clare cinnamomeis: rostro superiore nigro, inferiore plumbeo: pedibus virescentibus.

Long. tota 6·75, alæ 3·5, caudæ 3·0.

Five ex. "Irides dark hazel."

ANABATES TEMPORALIS.

Rufescenti-brunneus, cauda ferruginea; capite olivascente, oculorum ambitu et superciliis ante oculos angustis cum gula tota stramineis, striga superciliari post oculum, pectore toto et tectricibus subalaribus clare cinnamomeis: ventre crissoque fuscescentibus: rostro fuscescenti-viridi, apice pallidiore: pedibus fuscis.

Long. tota 6·0, alæ 3·6, caudæ 2·5.

Two ex. "Irides hazel."

DYSITHAMNUS UNICOLOR.

Obscure schistaceus unicolor: alis caudaque nigricantioribus: subalaribus albo variegatis: rostro nigro, pedibus plumbeis.

♀. *Obscure ferruginea, subtus dilutior: lateribus capitis cinerascentioribus.*

Long. tota 5·6, alæ 2·8, caudæ 2·3.

A pair of these birds, "from the lower trees and underwood: irides grey." The species must be placed next to *D. schistaceus* of my Synopsis. It differs in its shorter, stouter bill, the white markings beneath the wings, and want of white terminations to the rectrices. The brown bird is marked by Mr. Fraser as 'male;' but I have little doubt this is wrong.

FORMICIVORA CALOPTERA.

Cinerascenti-olivacea, fronte et superciliis albis: loris et regione oculari nigris: alis nigris, harum tectricibus minoribus et majoribus albo late terminatis; remigibus secunda, tertia, quarta et quinta albo, ceteris castaneo-rufo extus anguste limbatis: subtus alba; *subalaribus, lateribus corporis et crisso flavicante perfusis: cauda cinerea, rectricibus duabus utrinque extimis omnino et duabus sequentibus partim albis: rostro nigro, mandibulæ inferioris basi albicante, pedibus plumbeis.*

Long. tota 4·4, alæ 2·1, caudæ 1·8.

Three ex. "Irides hazel." Sexes, as marked, alike; but I should be inclined to consider them all males. The general appearance of this species is much the same as that of *Herpsilochmus rufimarginatus*; but the bill is much smaller and more feeble.

PACHYRHAMPHUS HOMOCHROUS.

♂. *Nigricanti-cinereus, subtus dilutior: plaga in basi interscapularium celata et macula ad basin primariorum interna albis: rostro superiore nigro, inferiore cum pedibus plumbeis.*

♀. *Castanea, subtus dilute cinnamomea, remigum parte interna nigricante.*

Long. tota 6·7, alæ 3·6, caudæ 2·7.

Three examples, one male and two females of this apparently undescribed species of *Pachyrhamphus*. It is closely allied to the rosy-breasted *Pachyrhamphus pectoralis* and its allies, but has no trace of colouring on the breast. The male has the usual second abnormal short primary. Mr. Fraser says in his notes, of the male (No. 1310), "Irides hazel; scaling of feet exactly like specimen No. 1307, of which I believe it to be the male. It was not found in the same tree, but close by. To me this is the most interesting bird I have collected in America, particularly as I believe it will confirm Mr. Sclater's views." "Contents of stomach insects."

CEPHALOPTERUS PENDULIGER*.

Niger, nitore nonnullo æneo: subalaribus albis nigro variegatis: appendiculo gutturali angusto, longissimo, ad mediam caudam

* A figure of this *Cephalopterus*, from Mr. Wolf's pencil, is given in the first number of 'The Ibis,' 1859 (pl. iii.).

attingente, omnino plumis obtecto: rostro superiore nigro, inferiore plumbeo; pedibus nigris.

Long. tota 14·5, alæ 9·5, caudæ 4·5, rostri a fronte 1·7, tarsi 1·8.

Two ex., both males. "Irides reddish." This extraordinary bird forms a third species of the peculiar genus *Cephalopterus* of Geoffroy St.-Hilaire, of which the type *C. ornatus* is now well known in collections, and commonly called the "Umbrella-bird." It is considerably smaller than *C. ornatus*, as may be seen by comparing the measurements given above with the following taken from a fine example of the latter species in Mr. Gould's collection. Whole length 17·5, wing 11·0, tail 6·5, bill from the front 1·9, tarsus 2·1. The peculiar characteristic of the present bird is, however, the length of the throat-lappet, which measures in one specimen 10 inches in length, in the other 8½ inches. In *Cephalopterus ornatus* the throat-lappet in the male measures about 4 inches. Here also it is much broader, and conceals a bare space on the neck, of which there is no appearance in the present bird. In *Cephalopterus glabricollis**, the only other known species of this curious form, which was discovered by Warscewicz in Veragua, described by Mr. Gould, and figured in the 'Proceedings Zool. Soc.' 1850, p. 92, pl. xx.), the fore-chest and neck, as well as the base of the throat-lappet, are entirely denuded.

Mr. Fraser's notes on this bird are, "*Bocinero*—found solitary in the high trees in the deep forest. His name is taken from his note, which resembles the noise made by the Indians when sounding their large shells, or (as others compare it to) the bellowing of a bull. At this time they are said to inflate the neck-appendage to nearly 3 inches in diameter, and to spread the crest as much over the face as possible. But a lady, who once had one alive, told me that when it slept its crest was thrown forward, and that when it uttered its note the feathers were thrown backward, showing the white stems. The appendage to the throat had not any opening to view; nor could one be found by blowing into the mouth or nostrils. It is rather contracted in drying than otherwise. The gizzard of one specimen contained fruit and seeds."

I have lately received from MM. Verreaux of Paris a skin of a *Cephalopterus* out of a collection received from Bogota. The specimen is not in good order, having been much contracted in drying, and deprived of its feet; but from its small size, white under wing-coverts, and narrow throat-lappet (which, however, is only 2·5 inches in length), it is apparently of this same species, being probably a female, or possibly a young male bird. It seems, therefore, probable that *Cephalopterus penduliger* occupies the valleys on the western side of the Andean range, as *C. ornatus* those on the eastern side, and that *C. glabricollis* takes their place in Central America.

* The suggestion of a recent writer in the Zoology of Castelnau's Expedition (Oiseaux, p. 65), that this species is the adult stage of *Cephalopterus ornatus*, we regard as simply ridiculous.

MISCELLANEOUS.

Notes on the Habits of Menura Alberti. By A. A. Leycester, Esq.

The *Menura Alberti* is famous for its most extraordinary mocking capabilities. It is found only on the Brisbane and Tweed rivers and in the neighbourhood of their waters. It inhabits the rushes, and generally chooses a sandy soil for its locality. I never saw more than a pair together, male and female. Each male bird has his walk or boundary, and gives battle if another male encroaches on it. He commences singing some time before the dawn of day, being the earliest of the forest-birds in this respect. His song is much varied, as, besides his own peculiar note, he imitates the cries of all the birds in the bush, such as the Laughing Jackass (*Dacelo gigas*), and even the mournful howl of the Owl and the thrilling scream of the Curlew. When singing and playing about, he spreads his tail over his back like a peacock. He scratches and pecks at the earth while singing, which he generally does until about an hour after sunrise. He then becomes silent, and remains so until about an hour before sunset, when he again commences, and continues singing and playing about until it is quite dark. This *Menura* feeds entirely upon insects, mostly small beetles, mingled with a goodly proportion of sand. It has no crop or upper stomach. The male bird is about four years old before he gets his full tail, as I have proved by shooting examples in full feather with the tail in four different stages of development; the two centre curved feathers are the last to make their appearance. It breeds in winter, commencing its nest in May, laying in June, and hatching its young in July. It generally builds on some bare rock where there is a sufficient shelter for a lodgment, so that no animals or vermin can approach. The nest is constructed of small sticks interwoven with long dry roots and moss, the inside being composed of the skeleton leaf of the parasitical tree-fern, which makes an inside lining, and is very similar to horse-hair. It is completely rain-proof, and has an entrance at the side. The hen lays only one egg, of a very dull colour, looking as if it had been blotched over with ink. The young bird when first hatched is covered with a white down, and remains in the nest about six weeks before it takes its departure. The flesh is not good for food, being of a dark colour, tough and dry. The aboriginal name is *Colwin*.—*Proc. Zool. Soc.* Feb. 14, 1860.

On Sertularia tricuspidata. By J. Reay Greene, Esq.

To the Editors of the Annals of Natural History.

Gentlemen,—Mr. Andrew Murray, in his "Descriptions of new *Sertulariadæ* from the Californian Coast," published at page 250 of the present volume of this Journal, has described a new species of *Sertularia* as *S. tricuspidata*.

But this name is preoccupied, having some years since been applied

by Mr. Alder to a well-marked British form of the genus. See his "Catalogue of the Zoophytes of Northumberland and Durham," in vol. iii. part 2 of the 'Transactions of the Tyneside Naturalists' Field Club.' See also page 356. vol. xviii. 2nd series, of this periodical.

I am, Gentlemen,
Your obedient Servant,
J. Reay Greene.

Queen's College, Cork,
April 10, 1860.

On the Genus Huxleya. By J. Reay Greene, Esq.

To the Editors of the Annals of Natural History.

Gentlemen,—In a paper by Mr. Arthur Adams "on some new Genera and Species of Mollusca from Japan," published in the last Number of this Journal, the title of *Huxleyia* has been conferred by the author on a new genus of *Lamellibranchiata* (vide p. 303).

Mr. Adams does not seem to be aware that the name *Huxleya* has already been given to a genus of *Polyzoa.* See "Notes on two new British Polyzoa," by Fred. D. Dyster, F.L.S.," in the 'Quarterly Journal of Microscopical Science,' 1858.

I am, Gentlemen,
Your obedient Servant,
J. Reay Greene.

Queen's College, Cork,
April 10, 1860.

On some young Hybrid Bears bred in the Gardens of the Zoological Society. By A. D. Bartlett.

In the Bear-pit in the Gardens a male Black Bear of America (*Ursus americanus*) has been kept for a long time with a female of the European Brown Bear (*Ursus arctos*). In the month of May these bears were seen to copulate, and on the 31st of last December the female produced three young ones; which, when born, were *naked* and *blind*, and about the size of a full-grown rat.

The mother was seen to carry one of these young ones in her mouth a day or two after they were born, and, as it disappeared, it is supposed that she devoured it. Probably it was not healthy. The other two remained and continued to grow, and at the age of five weeks were as large as a common rabbit. Their eyes began to open by this time; they were covered with a short thick fur, and were nearly black.

On examining these young bears it was found they were male and female, and the number and situation of the teats appears somewhat remarkable. They have six teats, four of them placed in front between the fore legs, and two of them in the lower part of the abdomen. Another singular fact is, that the female during the time she was suckling these young ones fed most sparingly, and rarely took any drink. From the before-mentioned observations we may infer that the period of gestation of the Bears is about seven months.—*Proc. Zool. Soc.* Feb. 28, 1860.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 30. JUNE 1860.

XLVI.—*On* Cyclostigma, *a new Genus of Fossil Plants from the Old Red Sandstone of Kiltorcan, co. Kilkenny; and on the General Law of Phyllotaxis in the Natural Orders* Lycopodiaceæ, Equisetaceæ, Filices, *&c.* By the Rev. SAMUEL HAUGHTON, F.R.S., Professor of Geology in the University of Dublin.

THE extremely imperfect condition in which fossil plants are usually found, and the almost total absence of their more important organs, lead us naturally to lay stress on such characters as are found persistent in the fossil condition. Among these, one of the most important, as I believe, is the geometrical law of arrangement of their leaves. A careful examination of this arrangement leads me to conclude that the leaves of Palæozoic fossil plants are arranged according to a different law from that which prevails in the ordinary Exogens and Endogens, and usually described in elementary text-books of botany.

The law of arrangement is very simple, and may be thus expressed:—

"*The leaves, or leaf-scars, are arranged in whorls, so placed that each leaf is directly above or below a leaf of the alternate whorls, and intermediate to the leaves of the adjacent whorls.*"

The development of leaves following this law may be easily conceived by imagining the whorl to ascend spirally on the stem, traversing an angle $\left(\frac{180°}{n}\right)$ between each of its resting-places; n denoting the number of leaves in each whorl. This is the same as supposing *each* leaf to have an independent law of development, of the ordinary kind, expressed by

$$\text{Divergence} = \frac{1}{2n}.$$

The leaves, according to this view, are developed in simultaneous

whorls, and cannot be supposed to be produced in succession, as in alternate-leaved plants.

Some of the whorled-leaved Exogens may be reduced to this law, such as the simple case of opposite-leaved plants, which is not reducible to the common law of phyllotaxis, as we cannot suppose the two opposite leaves to be produced in succession; but the great majority of Exogens follow a different law.

According to all writers on botany, the leaves of alternate-leaved Exogens and Endogens are placed upon the stem at angles represented by the fractions

$$\tfrac{1}{2}, \tfrac{1}{3}, \tfrac{2}{5}, \tfrac{3}{8}, \tfrac{5}{13}, \tfrac{8}{21}, \tfrac{13}{34}, \text{\&c.}$$

of an entire circumference.

In opposite-leaved plants, which is the simplest case of whorled structure, we cannot assign any such law of development to the leaves, even by calling to our aid the hypothesis of arrested growth, for the leaves succeed each other at intervals of $\frac{1}{2}$, $\frac{1}{4}$, alternately, and cannot be reduced to the phyllotaxis of alternate leaves. We should therefore, I believe, assign to all whorled plants a law of phyllotaxis of their own, which is very simple, as already stated.

The floral envelopes of almost all Exogens and Endogens follow this law of whorled structure, so much so that any deviation from it is remarked, and considered due to the suppression of a whorl, as in the case of the Primulaceæ. It is therefore evident that there must be some mode of passing from one law to the other, as both occur in the same plant. As it is impossible to reduce the law of whorled-leaved plants to that of the alternate-leaved plants, I have made some attempts in the opposite direction, but have not yet collected sufficient facts to draw any general conclusions. I shall give an example or two.

Many of the Exogens possess a five-leaved whorled arrangement of their floral organs, while the leaves of the stem are arranged alternately at a divergence of $\frac{2}{5}$. This may be deduced from four whorls in the following manner:—Let the alternate whorls be suppressed; if the remaining whorls were converted into a spiral, they would consist of two spires of five leaves each, with an angle of divergence of $\frac{1}{5}$; but if we suppose the alternate leaves suppressed, the two spirals would coalesce and form one, taking two turns round the axis, and containing five leaves, giving an angle of divergence of $\frac{2}{5}$.

If I were at liberty to adopt the Law of Natural Selection, I should say that, no doubt, the plant found it to its advantage to drop these supernumerary leaves, and so became elevated into the condition of an alternate-leaved plant.

In the preceding case, in order to deduce the arrangement of

the leaves from that of the flowers, we have supposed the suppression of alternate whorls, and of the alternate leaves of each whorl preserved, making a suppression of 75 per cent. of the leaves. In other cases, the suppression of leaves is only 50 per cent., as in the case of most Endogens whose flowers consist of alternating whorls of three organs. If we suppose, in this case, the suppression of alternate whorls, and a spiral arrangement, the divergence will become $\frac{1}{3}$.

In the case of opposite-leaved plants, the suppression of alternate whorls will give us the *distichous* arrangement, $\frac{1}{2}$, at an expenditure of 50 per cent. of leaves.

In these and many other cases, we can deduce, by the hypothesis of suppression, the alternate-leaved phyllotaxis from the whorled; and it is worthy of remark, and leads me to my more immediate subject, that the whorled arrangement, which is rare (with the exception of opposite-leaved plants) among Exogens and Endogens, was the common arrangement of leaves among the Coal-plants, and, so far as we know, among the plants of the Old Red Sandstone, which forms the base of the Carboniferous rocks.

The Palæozoic trees and plants are referred to natural orders, resembling in many respects our recent Lycopodiaceæ, Equisetaceæ, and Ferns. In all these orders, the whorled phyllotaxis of the kind I have described commonly prevails.

I. Lycopodiaceæ*.

1. *Lycopodium dendroideum* (Herb. Oakes). Canada. Leaves of stem arranged in alternate whorls of 7 leaves in each. Divergence of whorl = $\frac{1}{14}$.

2. *L. densum.* New Zealand. Leaves of stem in alternate whorls of 7 each. Divergence = $\frac{1}{14}$.

3. *L. clavatum.* Massachusetts. Leaves of stem and flower-stalk in alternate whorls of 7 each. Divergence = $\frac{1}{14}$.

4. *L. divaricatum.* Nepaul. Leaves of stem in alternate whorls of 11 each. Divergence = $\frac{1}{22}$. Leaves of flower-stalks in alternate whorls of 8 each. Divergence = $\frac{1}{16}$.

5. *L.* (n. sp.). Caraccas, S. America. Leaves of lower stem in alternate whorls of 7 each. Divergence = $\frac{1}{14}$. Leaves of upper stem in alternate whorls of 2 each (*i. e.* opposite-leaved). Divergence = $\frac{1}{4}$.

6. *L. volubile.* New Zealand. Leaves of lower stem in alternate whorls of 4 each. Divergence = $\frac{1}{8}$. Leaves of upper stem in alternate whorls of 2 each. Divergence = $\frac{1}{4}$.

* The plants examined by me for the purposes of this paper are those preserved in the Herbarium of Trinity College.

7. *L. Selago.* Canton Ticino. Leaves of stem in alternate whorls of 4 each. Divergence = $\frac{1}{8}$.

8. *L. reflexum.* Pacific. Leaves of stem in alternate whorls of 9 each. Divergence = $\frac{1}{18}$.

This plant has a striking external resemblance to *Lepidodendron minutum* and to some of the smaller Cyclostigmas of Kiltorcan.

9. *L. quadrifasciatum.* Leaves of stem in alternate whorls of 2 each. Divergence = $\frac{1}{4}$.

10. *L. verticillatum.* Mauritius. Leaves of stem in alternate whorls of 7 each. Divergence = $\frac{1}{14}$.

This plant resembles some of the Kiltorcan plants which have been called *Knorria.*

11. *L. gridoïdes.* Mauritius. Leaves of stem in alternate whorls of 2 each. Divergence = $\frac{1}{4}$.

12. *L. flagellarium.* New Zealand, North Island. Leaves of stem in alternate whorls of 2 each. Divergence = $\frac{1}{4}$.

13. *L. varium.* Lord Auckland's Islands. Leaves of stem in alternate whorls of 4 each. Divergence = $\frac{1}{8}$.

14. *L. catharticum.* Peru. Leaves of stem in alternate whorls of 2 each. Divergence = $\frac{1}{4}$.

15. *L.* (n. sp.). Quito. Leaves of stem in alternate whorls of 8 each. Divergence = $\frac{1}{16}$.

This plant bears a close external resemblance, on a smaller scale, to *Lepidodendron dichotomum.*

Sufficient evidence has been adduced to prove that the Lycopodiaceæ follow the geometrical law of alternate whorls. Collecting together the results, we find the following angles of divergence:—

In 6 species	an	angle of	$\frac{1}{4}$.
5	"	"	$\frac{1}{14}$.
3	"	"	$\frac{1}{8}$.
2	"	"	$\frac{1}{16}$.
1	"	"	$\frac{1}{18}$.
1	"	"	$\frac{1}{22}$.

These numbers correspond with whorls consisting of 2, 4, 8 leaves, being powers of 2, and whorls containing prime numbers of leaves 7, 9, 11.

The *prime* whorls could not give rise to any of the known phyllotaxes of alternate-leaved plants; but the whorls of powers of 2 may do so as follows:—

(1). The whorl of 2, by suppression of the alternate whorls, gives the phyllotaxis = $\frac{1}{2}$. Reduction of 50 per cent. of leaves.

(2). The whorl of 4, by suppression of the alternate whorls and alternate leaves, gives the phyllotaxis = $\frac{1}{2}$. Reduction of 75 per cent. of leaves.

(3). The whorl of 8 leaves, by suppression of the alternate whorls, and of $\frac{2}{3}$ of the remaining leaves, might give rise to the well-known phyllotaxis = $\frac{3}{8}$. Reduction of 83 per cent. of leaves.

It may be supposed by some that the plants, having got rid of superfluous leaves, expended the surplus vitality thus acquired in perfecting their flowers and fruit into higher types; but if this be so, how are we to account for the retention of the whorled structure in the floral organs?

The calyx, corolla, and stamens of Exogens and Endogens obey the law of alternate whorls, when definite; but the pistil in many cases progresses into the spiral type. When the carpels are few and definite, they form a whorl; but where indefinite, as in *Ranunculus, Myosurus,* and *Magnolia,* and such like cases, they are as strictly spiral as leaves. Also, in monstrous roses, we have the pistils returning to the condition of leaves,—green, cut, and spirally arranged.

II. Equisetaceæ.

1. *Equisetum alpestre.* Norway (North). Sheath whorls alternate, 4 in each. Branch whorls 7 in each.

2. *E.* (sp.). Ceylon. Sheath whorls alternate, 16 in each. Branch whorls (irregular), 1 in each. Fruit whorls 10–13 in number, alternate hexagons, 10 in each.

3. *E.* (sp.). Nilghiri Hills, S. India. Sheath whorls alternate, 24 in each. Ditto (upper part of plant) 8 in each. Branch whorls (irregular), 1–3 in each. Fruit whorls 10–12 in number, alternate hexagons, 8 in each.

4. *E. elongatum.* Mount Sarial, Georgia. Sheath whorls alternate, 12–14 in each. Fruit whorls 10 in each. Branch whorls 8 in each.

5. *E.* (sp.). Western Texas and New Mexico. Sheath whorls alternate, 24–30 in each.

6. *E. arvense.* Providence, Rhode Island; and Berne. Sheath whorls alternate, 8 in each. Fruit whorls (12–14 in number) alternate, 8 in each. Branch whorls 8 in each.

7. *E. limosum.* Providence, Rhode Island. Sheath whorls alternate, 14–16 in each. Fruit whorls (12 in number) alternate, 16 in each. Branch whorls 0–10 in each.

8. *E.* (sp.). Ipswich, Massachusetts. Sheath whorls alternate, 12 in each. Fruit whorls 12 in each.

9. *E. sylvaticum.* Ipswich, Massachusetts. Sheath whorls alternate, 12 in each. Branch whorls 10 in each.

10. *E. hyemale.* Mexico and Berne. Sheath whorls alternate, 16 in each. Fruit whorls (9 in number) alternate, 8 in each.

11. *E.* (sp.). California. Sheath whorls alternate, 16–24 in each. Fruit whorls (28–29 in number) alternate, 16 in each. Branch whorls 16–20 in each.

12. *E. debile.* E. Indies. Sheath whorls alternate, 24 in each. Branch whorls 4 in each.

13. *E. giganteum.* Peru. Lower sheath whorls alternate, 24 in each. Upper ditto alternate, 12 in each. Lower branch whorls 24 in each; upper ditto, 12 in each.

14. *E. fluviatile.* Berne and Limerick. Sheath whorls alternate, 24–30 in each. Fruit whorls 16–20 in each. Branch whorls 20–30 in each.

15. *E. arvense.* British. Branch whorls of barren stems 13 in each. Sheath whorls of fruitful stems 8 in each. Fruit whorls alternate (14 in number), 8 in each.

From an examination of the preceding, I conclude (rejecting the branch whorls, which are generally deficient in number) that the number of leaves in the alternate whorls of the Equisetaceæ are represented by the arithmetical series whose first term is 4, and common difference also 4:—

$$4?,\ 8,\ 12,\ 16,\ 20?,\ 24,\ 28?,\ 32?,$$

the terms to which I have appended queries being more doubtful than the others.

I at first thought there were two series—

$$4,\ 8,\ 16,\ 32,$$

and

$$12,\ 24,$$

formed by simple dichotomy; but the case of the Nilghiri Hill *Equisetum* proves the occurrence of 8 and 24 on the same plant, and the Californian *Equisetum* shows the concurrence of 16 and 24,—thus proving that there is only one series of numbers, and that a series in arithmetical progression. The whorl of 8 leaves, which, next to that of 16, is the most common, is the only one related to the phyllotaxis of alternate-leaved plants.

III. Filices.

The rhizome or root-stock of the Ferns presents many irregularities, the leaves being sometimes apparently alternate, but often truly arranged in whorls. The genus *Cyathea*, or Tree-fern, from the Feejee Islands, is that which presents most analogy to the fossil plants of the Old Red Sandstone, so far as the

leaf-scars are concerned. These scars are arranged in quincunx, and are ovoid or elliptical-lanceolate, according to the slowness or rapidity of the growth of the stem. Of the other Ferns I have examined, the *Oleandra* presents the most marked examples of the whorled structure.

1. *Cyathea* (sp.). Feejee Islands. Root-stock of specimen examined 4–5 feet long, containing 35 rows of whorls of 3 leaves each, placed alternately. The scars of this plant present the most striking resemblance to many of those found in *Lepidodendra.* The angle of divergence of the whorl is $\frac{1}{6}$.

By the suppression of alternate whorls, it would give the angle $\frac{1}{3}$, alternate-leaved, and, by the additional suppression of one-third of the remaining leaves, it would give the angle $\frac{2}{3}$: in this latter case the reduction of leaves amounts to 67 per cent. of the original leaves.

2. *Oleandra* (sp.). E. Indies. Leaves arranged in whorls of 5 each, two whorls placed close together, alternate, forming a complex or double whorl of 10 leaves. Each such pair of whorls placed about 2 or $2\frac{1}{4}$ inches distant from the whorls above and below it. Divergence $= \frac{1}{10}$.

3. *O. neriiformis.* Luzon. Leaves arranged in whorls of 6 each, placed two and two together, alternate, as in the preceding, and distant from those above and below them. Divergence $\frac{1}{12}$.

4. *O.* (sp.). Whorls of leaves in pairs, alternate, each whorl containing 5 leaves. Divergence $= \frac{1}{10}$.

5. *O.* (sp.). Khasya Hills. Whorls of leaves in pairs, alternate, each whorl containing 5 leaves. Divergence $= \frac{1}{10}$.

6. *O. Wallichii.* Nepaul and Assam. Whorls of leaves in pairs, alternate, 5 leaves in each whorl; the pairs of whorls are 3 inches apart. Divergence $= \frac{1}{10}$.

From the preceding facts we may infer that the whorled species of *Oleandra* are probably constructed on two types of whorls (5–6), both of which, by suppression of leaves, as already explained, may be reduced to the phyllotaxis of alternate-leaved plants.

7. *Aspidium Filix mas.* Britain. In this Fern the rootstock exhibits an arrangement of leaves and leaf-scars, alternate, 7–8 in each whorl, as is well shown in the 'Annals of Nat. History,' December 1859, Pl. X. fig. 9.

In the Ferns and Club-Mosses, the whorled arrangement of leaves, although following the usual law, appears to be insufficient to produce the division of the stem into nodes, as happens in the Equisetaceæ and some other natural families.

The next case to which I would direct attention is that of the *Casuarineæ,* represented by an old-fashioned genus, *Casuarina,* mostly confined to Australia and Tasmania, though it has

some species in the East Indies and elsewhere. In this case, the whorled structure is perfect, as much so as in *Equisetum*, although it is an Exogen, and apparently of a high order. Whether this group survives, like other Australian forms, as the representative of lost groups, or is to be regarded as a new and well-developed type, the result of careful selection on the part of the goddess Nature, I leave for the consideration of those acquainted with the secrets of Creation.

IV. Casuarineæ.

1. *Casuarina Lehmanniana*. Tasmania. Leaves in whorls of 8, alternate. Divergence $= \frac{1}{16}$.
2. *C.* (sp.). Tasmania. Leaves in whorls of 6, alternate. Divergence $= \frac{1}{12}$.
3. *C.* (sp.). Australia. Leaves in whorls of 8, alternate. Divergence $= \frac{1}{16}$.
4. *C. Miguelii*. Tasmania. Leaves in whorls of 8, alternate. Divergence $= \frac{1}{16}$.
5. *C. Grumii*. Tasmania. Leaves in whorls of 10, alternate. Divergence $= \frac{1}{20}$.
6. *C. quadrivalvis*. Tasmania. Leaves in whorls of 10, alternate. Divergence $= \frac{1}{20}$.
7. *C. equisetifolia*. Canara, East Indies. Leaves in whorls of 8, alternate. Divergence $= \frac{1}{16}$.
8. *C.* (sp.). Swan River. Leaves in whorls of 4, alternate. Divergence $= \frac{1}{8}$.
9. *C. Preissiana*. Eliza Mountain, Freemantle. Leaves in whorls of 4, alternate. Divergence $= \frac{1}{8}$.
10. *C. muricata*. Leaves in whorls of 6, alternate. Main stems have leaf-scars of 7–8, alternate. Divergence $= \frac{1}{12}$.
11. *C.* (sp.). Feejee Islands. Leaves in whorls of 8, alternate. Divergence $= \frac{1}{16}$.
12. *C. nana*. Leaves of stem, smaller branches, and carpels of fruit cones, in whorls of 5, alternate. Divergence $= \frac{1}{10}$.
13. *C.* (sp.). Swan River. Whorls of stem and fruit, 7, alternate. Divergence $= \frac{1}{14}$.
14. *C.* (sp.). Philippine Islands. Whorls of stem and fruit, 7, alternate. Divergence $= \frac{1}{14}$.
15. *C. distyla*. Tasmania. Leaves in whorls of 7, alternate. Fruit carpels in whorls of 7, alternate. Divergence $= \frac{1}{14}$.
16. *C. obesa*. Near town of Perth, Swan River: a tree 35 feet high. Leaves in whorls of 12, alternate. Carpels in whorls of 12, alternate. Divergence $= \frac{1}{24}$.
17. *C.* (sp.). Swan River. Leaves in whorls of 7, alternate. Divergence $= \frac{1}{14}$.
18. *C.* (sp.). Swan River. Leaves in whorls of 5, alternate.

Fruit whorls 5, alternate, showing 10 vertical rows of opened carpels. Divergence $= \frac{1}{10}$.

19. *C.* (sp.). Swan River. Leaves in whorls of 6, alternate. Divergence $= \frac{1}{12}$.

20. *C.* (sp. with spinous, slightly twisted leaves). Swan River. Leaves in whorls of 4, alternate. Fruit whorls of 4, alternate, showing 8 vertical rows of carpels. Divergence $= \frac{1}{8}$.

21. *C.* (sp.). Swan River. Leaves in whorls of 9, alternate. Fruit whorls of 9, ditto. Divergence $= \frac{1}{18}$.

22. *C. Hugeliana* (35 feet high). Mount Brown, 900 feet. Leaves in whorls of 8, alternate. Divergence $= \frac{1}{16}$.

23. *C.* (sp.). West Australia, between Perth and King George's Sound. Leaves in whorls of 7, alternate. Fruit whorls ditto. Divergence $= \frac{1}{14}$.

24. *C.* (sp.). W. Australia. Leaves in whorls of 8, alternate. Fruit whorls ditto. Divergence $= \frac{1}{16}$.

25. *C. rigida*. Port Phillip. Leaves in whorls of 7, alternate. Divergence $= \frac{1}{14}$.

26. *C. cristata*. Avoca. Leaves in whorls of 12, alternate. Divergence $= \frac{1}{24}$.

27. *C. rigida*. Sealer's Cove. Leaves in whorls of 8, alternate. Divergence $= \frac{1}{16}$.

28. C. (sp.). Common "She Oak" of Cape Riche, forming a large tree. Cape Riche, West Australia. Leaves in whorls of 10, alternate. Fruit whorls ditto. Divergence $= \frac{1}{20}$.

29. *C.* (sp.). Cape Riche, W. Australia. Leaves in whorls of 9, alternate. Fruit whorls ditto.

30. *C.* (sp.). Vavau and Lifuka, Friendly Islands. Leaves in whorls of 7, alternate. Fruit whorls ditto. Divergence $= \frac{1}{14}$.

31. *C.* (sp.). Near Cape Riche, W. Australia. Leaves in whorls of 5, alternate. Fruit whorls ditto. Divergence $= \frac{1}{10}$.

32. *C.* (sp.). Between King George's Sound and Cape Riche. Leaves in whorls of 9, alternate. Divergence $= \frac{1}{18}$.

33. *C.* (sp.). Between King George's Sound and Cape Riche. Leaves in whorls of 5, alternate; leaf-scars on old stem and twigs very Lepidodendriform and quincuncial. Fruit whorls of 5, alternate. Divergence $= \frac{1}{10}$.

34. *C.* (sp.). Near Cape Riche, W. Australia. Leaves in whorls of 5, alternate. Leaf-scars of stem well marked. Fruit whorls of 5, alternate. Divergence $= \frac{1}{10}$.

On comparing the numbers of leaves in the whorls, it appears that they may all be reduced to the following—

$$4,\ 5,\ 6,\ 7,\ 8,\ 9,\ 10,\ 12,$$

the favourite numbers being 5, 7, and 8. The angles of divergence are denoted by the reciprocals of these numbers, doubled,

as already explained. In fact, the perfect whorl must be considered as made up of two adjacent whorls, the leaves of which, being intermediate, give double the number, or only half the interval between each for the angle of divergence.

V. Proteaceæ.

A very remarkable group of Exogens, the Proteaceæ, possesses among its number many whorled species, which supply us with numbers additional to those of the Casuarineæ. In the family of Casuarineæ we found the number 5, which forms so important an element in the other Exogens; and in the Proteaceæ we meet with the number 3, which is only less important.

1. *Lambertia ericifolia.* Swan River. Leaves arranged in whorls of 3, alternate. Branches, flowers, and fruit follow the same law. Divergence $= \frac{1}{6}$.

As all the species of *Lambertia* which I have examined follow this law, it will be sufficient to give their names and localities:

2. *L. uniflora.* Swan River.
3. *L. multiflora.* Swan River.
4. *L. ilicifolia.* Swan River.
5. *L.* (sp.). Swan River.
6. *L.* (sp.). Near Cape Riche, W. Australia.
7. *L.* (sp.). Ditto.
8. *L.* (sp.). Ditto.
9. *L.* (sp.). King George's Sound.
10. *L.* (sp.). Sydney, New South Wales.
11. *L. inermis.* Between Perth and King George's Sound. Variety with yellow flowers.
12. *L.* (sp.). King George's Sound.
13. *L. formosa.* New South Wales.

(Divergence in all cases $= \frac{1}{6}$.)

14. *Brabejum* (sp.). Cape of Good Hope. Leaves in whorls of 6, alternate. Divergence $= \frac{1}{12}$.

15. *B.* (sp.) Cape of Good Hope. Leaves and branches in whorls of 8, alternate. Divergence $= \frac{1}{16}$.

16. *B. stellatum.* Cape of Good Hope. Three specimens examined, from different collections. In all of them I found the number of leaves in the alternate whorls to be 7, giving thus a divergence of $\frac{1}{14}$.

VI. Ericaceæ.

In this large and important order of Exogens, the whorled law of arrangement universally prevails, the number of leaves in each whorl being

2, 3, 4, 6, and occasionally 7.

These whorls all conform to the law laid down, and give rise to diverging angles of

$$\frac{1}{4}, \frac{1}{6}, \frac{1}{8}, \frac{1}{12}, \frac{1}{14}.$$

In this natural order, 3 leaves in the whorl often occur, as also in the Proteaceæ : the other numbers of leaves in the whorls have been already met with ; and that of 2 in the whorl, or opposite-leaved plants, is universal through the whole group of Exogens.

VII. Cyclostigmaceæ.

The fossil plants of the Yellow Sandstone of the co. Kilkenny occur, as they do in other parts of Ireland, in the Sandstones lying immediately under the great mass of the Carboniferous Limestone, which constitutes the most important member of our Irish fossiliferous rocks.

They are found at Jerpoint, about a mile and a half south of the Abbey, on the roadside, near the Corn-mill on the road to Ballyhale, about 90 feet below the lowest bed of limestone, in rocks composed of red, white, and blue limestone with Tribo-liths formed of pink quartz rounded pebbles grooving the hone-stone; and above the plant-beds a remarkable white grit conglomerate is found. The plant-beds, on the same geological horizon, are also found in the railway cutting at Ballyhale.

They are found, however, in the greatest abundance, and in the best state of preservation, on the top of Kiltorcan Hill, near the railway station of Ballyhale. I believe the plant-beds on the summit of this hill to form an "outlier," and to occupy the same geological position with respect to the limestone as the beds at Jerpoint and those of the railway cutting.

The fossil plants here found have never been described, except casually: they consist of remains of a large Fern, called *Cyclopteris Hibernica* by Prof. Forbes, associated with a large bivalve, named by him *Anodon Jukesii*; of undescribed dermal plates of a cartilaginous fish, probably a species of *Coccosteus*; and of numerous unknown plants closely allied to *Lepidodendron*, and so named by Prof. Forbes and M. Brongniart, the latter of whom has named a remarkable species, preserved in the Museum of the Royal Dublin Society, *Lepidodendron Griffithii*. Others of these fossil plants have been named *Knorria*; and a large undescribed group remains, to which I propose to give the name *Cyclostigma*.

Cyclostigmaceæ.

A natural order of fossil plants, found in the lowest beds of the Carboniferous system, part of the oldest flora known to have

existed on the globe. Probably closely allied to the orders described as *Knorria, Lepidodendron,* and *Sigillaria.* Known only by their leaf-scars and leaves, which were arranged in alternate whorls; plants not jointed at the whorls; the leaf-scars perfectly circular, showing in many cases a minute and well-marked dot in the centre, probably coinciding with a central bundle of woody tissue; many of the larger plants show traces of a thick central woody axis, like that found in *Stigmaria;* stems much crushed and flattened, as if they were not woody throughout.

They approach nearest to *Stigmariaceæ,* from which they differ in the leaf-whorls being further apart and more distinct.

There are many varieties of this remarkable fossil, showing the alternate whorled arrangement of leaf-scars. None of them are perfect stems, but appear to be torn portions of the rind of large plants which have been macerated by floating for a long time in water. In the quarry at Kiltorcan the *Cyclostigma* is found in layers different from those in which the *Cyclopteris Hibernica* occurs.

In some specimens of *Cyclostigma* the leaf-scars are closer together than in the last, and are somewhat oblique to the transverse line of the stem,—this obliquity being due to distortion caused by lateral pressure of the mudstone in which the fossils occur. The whorled arrangement of the leaves, each whorl being alternate to that above and below it, is frequently well shown.

Cyclostigma Kiltorkense.

Stem (flattened) $3\frac{1}{2}$ inches in diameter. Leaves in alternate whorls, 25 in each whorl; whorls 1 inch apart. Divergence $=\frac{1}{50}$. Central woody axis $\frac{6}{10}$ inch in diameter (flattened), shown by the strongly marked band in the centre of the stem.

This is the largest of the species of *Cyclostigma* found at Kiltorcan, and I have given its specific name from the locality.

Cyclostigma minutum.

Leaves in alternate whorls, the whorls being somewhat more distant from each other than the leaves; the centre of each leaf-scar marked by a well-defined minute dot. Branches of stem dichotomous.

This is the species figured in Sir Charles Lyell's 'Manual,' 5th edition, p. 418. It is a well-marked and easily-recognized fossil. It is also the same as the fossil figured by me in the Journal of Geol. Soc. Dublin, vol. vi. p. 235, and named *Lepidodendron minutum.* The latter was found at Tallow Bridge, co. Waterford.

Cyclostigma Griffithii.

Leaves in alternate whorls, 40 in each whorl; whorls less than $\frac{1}{2}$ inch apart. Divergence $= \frac{1}{80}$. Stem 2·2 inches in diameter (flattened). The leaves of the whorls are rendered oblique to the transverse axis by distortion; and where oblique, there are 6 leaf-intervals to the inch; but where they run across the stem in their natural position, there are 9 to the inch.

I have much pleasure in naming this species after Sir Richard Griffith, in whose Yellow Sandstone territory many specimens of it occur, and, by their general analogy to the Carboniferous *Lepidodendra*, vindicate the propriety of considering, as he has done, the sandstones and conglomerates among which they are found as the natural base of the Carboniferous system of Ireland.

XLVII.—*On the Occurrence of a Sucker-like Adhesive Apparatus in the* Daphniadæ *and allied Crustacea.* By Rudolph Leuckart*.

[With a Plate.]

During my residence at Nice in the spring of 1853, I observed a small Entomostracan of the group of the *Daphniadæ*, which, notwithstanding its similarity to *Polyphemus*, Müll., belonged, from the formation of its large antennæ and of its abdomen, to the genus *Evadne*, Lov. I regarded it as new, and called it *Evadne polyphemoïdes*. (Similar species, but differing in the number of joints in the large antennæ, have been described by Dana under the name of *Polyphemus brevicaudis*, and also by Liljeborg under that of *Podon intermedius*, Kröy.) The same animal has since been seen and investigated at Heligoland by Pagenstecher and myself.

The following characters may be given to distinguish my species. The legs gradually become shorter and more closely approximated posteriorly. Instead of the long and slender terminal setæ, the two middle legs bear two short and thick hooks with the inner margin plumose. The secondary appendage of the last pair of legs is almost obsolete. The lower vitreous cones of the enormous eye are separated from the rest by a space, and are considerably shorter than the preceding ones; the last of all are also of a different, pyriform shape.

What most tended to fix my attention on this little animal was an unmistakeable, large, round sucking-disk (Pl. XVI. B. fig. 8),

* Translated by W. S. Dallas, F.L.S., from Wiegmann's Archiv, 1859, p. 262.

which it bore upon its back at some distance from the anterior end of the shell. This had the form of a plate-like pit, with a swelled margin and distinct muscular structure,—annular fibres in the periphery, and radiating fibres in the middle. Even if the structure of this organ could have left any doubt as to its function, this could not but disappear when I saw the animal attach itself to the side of the glass by means of this apparatus.

The organ in question has already been repeatedly seen by previous observers, and must occur pretty frequently in the allied animals, although perhaps rarely so perfectly developed. Nevertheless, its signification has hardly yet been recognized,—a circumstance which may perhaps partly be due to the fact that sucker-like adhesive organs usually occur only amongst parasites, and are almost wholly wanting amongst the Arthropoda.

Amongst those naturalists who observed this structure before me, I may especially mention Lovén, who describes it in *Evadne Nordmanni* as a "circular muscle" attached to a depression in the shell, and consisting of radiating fibres. Lovén regards this "muscle" as a part of the ordinary cutaneous layer of muscles, without referring further to its peculiarities or indicating its function. Liljeborg saw the same sucker in *Polyphemus* (De Crustaceis ex ordin. trib., 1853, tab. 5. fig. 3), but regarded it, singularly enough, as an organ of secretion.

The only observer who, as far as I know, had a correct notion of the organ in question is Strauss-Durckheim, who describes (Museum Senckenberg. 1837, ii. p. 126) a "head-lobe" (*Kopfzapfen*) as a characteristic organ, previously overlooked, in *Limnadia*, "by means of which these animals can adhere."

The faculty of attaching themselves by the neck to foreign objects occasionally, however, is well known to be possessed by other allied Entomostraca. Even O. F. Müller mentions, in his work upon the Entomostraca, that he has often seen *Sida crystallina* in this position, with its head hanging down; and the same thing has been stated by subsequent observers, although Zaddach (Synops. Pruss. Crustac. Prodrom. 1844, p. 26) admits that he does not know by what organ an adhesion of this kind observed by him in certain species of *Daphnia* and *Lynceus* can be effected.

When we have once made acquaintance with the sucking-disk of *Evadne*, it is not difficult to discover, even in the other animals, and especially in *Sida*, a flattened, more or less projecting tubercle in the region of the neck, and to recognize this as an adhesive apparatus, although the muscularity is much less distinct, and may perhaps differ in its arrangement from that previously described.

The existence of this dorsal sucker is, however, interesting,

not merely on its own account, but more especially because by its means we get a new relation of these animals to the Cirripedia *. Even Strauss-Durckheim remarks, with regard to the cephalic tubercle (*Kopfzapfen*) described by him, that it may be compared with the stalk of *Lepas*; and, in fact, we need only imagine it more strongly developed and constantly adherent, to develope the structure just mentioned from it, and thus to approximate our Entomostraca very considerably to the Cirripedia. The resemblance would be a perfect analogy, if the statement of Thompson (Zool. Researches, i. part 1)—the first discoverer of the metamorphosis of the Cirripedia †—should be confirmed, that the bivalve-shelled larvæ of these animals adhere by the back, and that the future point of attachment may be detected in the suture between the shells, even in specimens which are still swimming freely about.

In opposition to these statements, however, it must not be concealed that, according to other observers, the attachment of the Cirripedia is not effected by the back, but by the antennæ, which likewise bear a small sucking disk at their extremity. This is the opinion especially of the most recent and thorough investigator of the Cirripedia (Darwin), who regards the stalk of the Barnacle as the anterior part of the head, and in some forms detected two persistent antennæ at its extremity.

Of course mere arguments from analogy cannot be set in opposition to such definite statements; but we cannot suppress the observation that the morphology of the Cirripedia is not yet perfectly cleared up, even after the minute investigations of Darwin. There are gaps also in the observations, and that exactly at the most important points for the decision of the question before us.

EXPLANATION OF PLATE XVI. B.

Fig. 8. *Evadne polyphemoïdes*, Leuck., n. s.

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* It is possible that the filiform adhesive apparatus on the forehead of *Chalimus* and some species of *Caligus* should also be regarded as the analogue of the dorsal sucker in the *Daphniadæ*. Recent investigations by Hesse (Comptes Rendus, xliv. p. 1254) prove that the young *Lerneæ* also adhere for a time by a frontal filament of this nature.

† Slabber, however, had already seen and figured the larvæ of a Barnacle (Naturk. Verlust. pl. viii. fig. 3), but without recognizing their nature. He saw these little animals escape in countless numbers from the opened shell, and regarded them as parasites.

XLVIII.—*On Additions to the Madeiran Coleoptera.* By T. Vernon Wollaston, M.A., F.L.S.

[Continued from p. 365.]

Fam. Curculionidæ.

Genus Rhyncolus.

(Creutzer) Germ., Ins. Spec. 307 (1824).

Rhyncolus calvus, n. sp.

R. piceus vel nigro-piceus, nitidus, calvus; prothorace profunde punctato; elytris sat profunde punctato- (fere etiam subcrenato-) striatis, interstitiis parce et minutissime punctulatis; antennis pedibusque piceo-ferrugineis.

Long. corp. lin. $1\frac{1}{2}$.

Habitat Maderam australem, in ligno antiquo ad "Praia Formosa" a Dom. Bewicke repertus.

R. piceous or dark-piceous (when immature, ferruginous), shining, and free from pubescence. *Rostrum* rather narrower than that of the *R. tenax*, and with less appearance of a central keel. *Prothorax* deeply punctured, the punctures being larger and less dense than in that insect, and with a few very minute punctules interspersed between them, but without any appearance of the *subalutaceous* sculpture which is there so evident; also more oval or more regularly rounded at the sides than in the *R. tenax*, not being so suddenly expanded about the middle, and with still fainter indications (if indeed any) of a central line. *Elytra* usually a little more picescent than the prothorax; rather deeply punctate- (or almost subcrenate-) striate, and with a very few and extremely minute punctules down the interstices; a little more rounded-off at the shoulders than in the *R. tenax*, and free from the closely rugulose sculpture which is so characteristic of that species. *Limbs* piceo-ferruginous.

The above *Rhyncolus* is closely allied to two species which I have captured in the Canary Islands; nevertheless it is just perceptibly narrower and more linear than either of them, as well as a little more piceous; its rostrum is not so broad, and its sculpture is somewhat shallower, its prothoracic punctures being also more dense (particularly in front), and its elytral striæ (though deep) not so decidedly *punctured*, having a more evident tendency to be subcrenulate. It was detected by Mr. Bewicke amongst old rotten wood, during May of 1857, in a small outhouse, at the Praia Formosa, near Funchal.

Genus Hexarthrum, nov. gen.

Corpus ut in *Rhyncolo*, sed *rostro* breviore (*i. e.* brevissimo) crassiore triangulari (*i. e.* antice sensim attenuato); *scrobe antennali* bre-

vissimo, fere medium versus oculi (valde demissi) ascendente: *antennis* brevissimis incrassatis; scapo brevissimo valde clavato; funiculo 6-articulato, art° 1mo magno, apice truncato, reliquis longitudine æqualibus, latitudine vix crescentibus, omnibus inter se arcte compressis et ultimo clavæ sat arcte adpresso; capitulo solidissimo ovato, apice obtuso, haud annulato. *Pedes anteriores* basi approximati, *postici* parum distantes: *tarsis* brevioribus quam in *Rhyncolo*, art° 3^{tio} multo minore minus dilatato.

Ab ἕξ, sex, et *ἄρθρον*, articulus.

The remarkable insect from which the above characters have been drawn has at first sight much the appearance of an ordinary *Rhyncolus*, with which, indeed, before examination, I had inadvertently associated it. But, on further inspection it will be found to differ in the most essential particulars,—its 6-jointed funiculus (instead of 7-), in conjunction with the shortness and breadth of its *subtriangular* rostrum, and the small size of its almost unexpanded antepenultimate tarsal joint (in which respect it makes an approach to *Leipommata*), at once separating it from the members of that genus. Moreover, the excessive brevity and thickness of its antennæ—the scape of which is remarkably short and robust, and the joints of the funiculus (except the enlarged basal one) closely pressed together, and with the club extremely solid, not perceptibly annulated, and very obtuse at its apex—is another feature which will still further remove it from the *Rhyncoli*.

Hexarthrum compressum, n. sp.

H. subcylindricum, piceum, subnitidum; rostro profunde et dense punctato (punctis plus minus longitudinaliter confluentibus); prothorace valde profunde punctato (punctis magnis); elytris profunde striato-punctatis et dense rugulosis, interstitiis latiusculis et longitudinaliter minutissime punctulatis; antennis pedibusque vix dilutioribus.

Long. corp. lin. $1\frac{1}{2}$.

Habitat Maderam australem, in ligno antiquo ad "Praia Formosa" a Dom. Bewicke captum.

H. subcylindrical and rather depressed, piceous, slightly shining, and (except under a high microscopic power) almost free from pubescence. *Rostrum* very short, broad, and triangular, without any central keel, but closely and deeply punctured,—the punctures having a greater or less tendency to be longitudinally confluent. *Prothorax* very deeply and regularly punctured (the punctures being extremely large, but also with a little tendency to be disposed in longitudinal furrows down the disk), its broadest part further *behind* than in the *Rhyncolus tenax*, and less evidently margined along its extreme posterior edge than in that insect. *Elytra* densely rugulose and deeply

striate-punctate, the punctures being very large; the interstices rather wide and flattened, and with a row of minute punctules down each. *Antennæ* and *tarsi* rufo-ferruginous; the *femora* and *tibiæ* scarcely paler than the rest of the surface; the body beneath densely and deeply punctured all over.

The discovery of the present insect is due to the researches of Mr. Bewicke, who has captured several specimens of it, in company with the *Rhyncolus calvus*, amongst rotten wood, at the Praia Formosa, near Funchal.

Genus Pentarthrum.

Wollaston, Ann. of Nat. Hist. ser. 2. vol. xiv. p. 129 (1854).

In their outward facies the two insects described below are moulded less on the true *Cossonus* type than the curious little Wood-feeder, detected in the West of England, for which I originally established, in 1854, the genus *Pentarthrum*. Nevertheless, since they clearly belong to this immediate section of the *Curculionidæ*, and agree with the *P. Huttoni* in possessing the anomalous character of a 5-jointed funiculus, I have preferred regarding them as congeneric with the British species to erecting an additional genus for their reception. In their convex, glabrous bodies indeed, and general contour, they are more suggestive of *Caulotrupis*, perhaps, than of *Mesites* or *Cossonus*; whilst from the *Pentarthrum Huttoni* they recede (especially, however, the *P. Monizianum*) in their more apically-inserted antennæ and less straightened rostrum, as well as in their excessively minute and almost obsolete eyes. In the *P. Monizianum* indeed there is scarcely any trace, with an ordinary lens, of the organs of sight; but when the head is viewed beneath a microscope, one can perceive (though not without some difficulty), adjoining the upper-edge of the extreme termination of the rostral groove, 5 or 6 closely-set depressed tubercles, within a small enclosure, —which are clearly the rudiments of an eye; but so abortive are they, that there can be but little doubt that the insect must be practically blind. In the *P. Bewickianum* these rudimentary eyes are a trifle more prominent, and therefore perceptible; but as regards their development, they do not appear to be at all more perfect.

§ I. *Antennæ longiusculæ graciliusculæ, rostri apicem versus insertæ, articulis funiculi inter se laxis, capitulo abrupto ovato. Rostrum ad antennarum insertionem sensim dilatatum.*

Pentarthrum Monizianum, n. sp.

P. piceum vel rufo-piceum, nitidum; prothorace profunde punctato; elytris ellipticis leviter striato-punctatis (punctis minoribus), in-

terstitiis latiusculis et punctulis minutissimis distantibus longitudinaliter obsitis.

Long. corp. lin. $1\frac{1}{2}$–vix $1\frac{2}{3}$.

Habitat Maderam australem; in horto quodam Funchalensi inter lignum antiquum copiose legit Dom. Moniz, cujus in honorem speciem stabilivi.

P. piceous or rufo-piceous, shining, and free from pubescence. *Rostrum* rather long, deeply punctured, and a little expanded about the insertion of the antennæ. *Prothorax* ovate, and straightly truncated behind, the broadest part being *almost* at the extreme base; deeply and regularly punctured. *Elytra* elliptical, being much rounded off at the shoulders, and with their broadest part about the middle; very lightly, but regularly, striate-punctate (the punctures being small); the interstices broad, and with a series of excessively minute and distant punctules down each. *Limbs*, except the antennal club, scarcely paler than the rest of the surface.

Detected, in abundance, by Sr. Moniz, during the spring of 1858, in old boards lying on the damp earth, in his garden at Funchal. It was, however, first captured by myself in the Canary Islands, where I took a single specimen in a house at Orotava, in the north of Teneriffe, during March of the previous year.

§ II. *Antennæ breviusculæ robustæ, ante medium rostri insertæ, articulis funiculi transversis inter se arcte compressis, capitulo minus abrupto oblongiore. Rostrum ad antennarum insertionem vix latius.*

Pentarthrum Bewickianum, n. sp.

P. rufo-piceum, nitidum; prothorace sat profunde et paulo crebrius punctato; elytris subparallelo-ellipticis, rugulosis, sat profunde et dense substriato-punctatis (punctis majoribus).

Long. corp. lin. 1–vix. $1\frac{2}{3}$.

Habitat Maderam australem; in ligno antiquo ad "Praia Formosa" detexit Dom. Bewicke insectorum Maderensium scrutator indefessus, qui pauca specimina ægre conservata nuper mihi benigne communicavit.

P. like the last species, but perhaps a shade more rufescent, and with its *rostrum* a trifle broader and shorter, and less evidently widened at the insertion of the antennæ (which are shorter and comparatively thicker, with the joints of their funiculus more compressed *inter se*, and their club less abrupt than in that insect; and which moreover do not arise *quite* so near to the apex). *Prothorax* as in the *P. Monizianum*, but a trifle less convex on its hinder disk, and just perceptibly less deeply and more closely punctured. *Elytra* a little more parallel (or less

elliptic) in their outline, and more rugulose; also more deeply, and much more closely, substriate-punctate, the punctures being considerably larger and more numerous, each series, however, being composed successively of slightly larger and smaller ones alternately.

The present insect, which is very much more variable in stature than the last (the smallest specimens being only a line in length), was discovered by Mr. Bewicke amongst old wood in a small shed, or out-house, at the Praia Formosa, near Funchal. In conjunction with the *P. Monizianum*, it is a most important addition to our fauna.

Genus Caulotrupis.

Wollaston, Ins. Mad. 308 (1854).

Caulotrupis subnitidus, n. sp.

C. ovato-subcylindricus, crassiusculus, niger, subnitidus, alutaceus; prothorace amplo, subtiliter punctato; elytris leviter striato-punctatis; antennis ferrugineis; pedibus piceis.

Long. corp. lin. $1\frac{3}{4}$–2.

Habitat in ramis emortuis *Euphorbiæ piscatoriæ*, in locis Maderæ inferioribus passim.

C. ovate-subcylindric and thick, black, minutely alutaceous all over, and subopake, or only very slightly shining. *Rostrum* short and broad in the males, longer and more slender in the females. *Prothorax* large; minutely, but quite perceptibly, punctulated; and broadest about the middle. *Elytra* rather straightened towards the shoulders; lightly, but distinctly, striate-punctate; and broadest about the middle. *Antennæ* short, and ferruginous. *Legs* piceous.

The present *Caulotrupis* is very closely allied to the *C. lacertosus*; nevertheless it is, on the average, a trifle larger than that species, its surface (although equally alutaceous) is less opake, the punctules of its prothorax are more evident, its elytra are just perceptibly more straightened towards the shoulders [which is best seen when the insect is viewed with its head pointed backwards], and have their striæ deeper and more decidedly punctured (but with the interstices less so); its habits are also apparently different—all the specimens of it which I have as yet seen having been captured from the dead stems of the *Euphorbia piscatoria* of low elevations (under which circumstances it was first detected by myself, towards Caniço, to the east of Funchal, on the 23rd of December 1858); whereas the *C. lacertosus* occurs beneath the bark of laurels of loftier altitudes. It has also been captured by Sr. Moniz and Mr. Bewicke.

(Subfam. Cryptorhynchides.)

Genus Acalles.

Schönherr, Curc. Disp. Meth. 295 (1826).

Acalles cinereus, n. sp.

A. oblongo-ovatus, squamis albido-cinereis dense tectus; prothorace subintegro fere concolore, ad apicem leviter setuloso; elytris sat profunde punctato-striatis, ad latera rotundatis, carinis interruptis nodulisque majoribus subsetosis instructis, plaga communi postmedia albidiore obscurissima (antice in medio indistincte fusco-terminata) ornatis.

Long. corp. lin. 3.

Habitat in sylvaticis editioribus Maderæ, a Rev. Dom. Lowe Decembri ineunte A.D. 1858 repertus.

A. oblong-ovate, and densely clothed with whitish-cinereous scales. *Rostrum* piceous; opake, and very coarsely punctured, in the males; a little slenderer, shining, and less punctured in the females. *Prothorax* rather less expanded in the middle than is the case in most of the sylvan species, and with its surface almost entire, there being scarcely any indications of tubercles, and only a few small setæ at its apex. *Elytra* rather deeply punctate-striate; with the interrupted ridges and nodules only moderately developed; and with a very faint and ill-defined transverse postmedial paler patch, common to both—almost suffused behind, but terminated in front by a more evident brownish portion, colouring the central tubercles. *Limbs* as in most of the other species.

A single specimen (and that a male) of this rather large and almost uniformly cinereous or whitish-cinereous *Acalles*, which has its prothorax nearly free from nodules and setæ, and its (slightly paler) elytral patch very obscure and ill-defined (particularly behind), was captured by the Rev. R. T. Lowe, during our encampment at the head of the Boa Ventura, in December 1858, in the crevices of a dead stem of the *Euphorbia mellifera*, at a very lofty elevation below the Boca das Torrinhas. There were two more of them in company with it, but these he unfortunately did not secure. A second example (a female) has lately been communicated by Mr. Bewicke, taken by himself (I believe at the Lombo das Vacas) during the summer of the following year. It belongs to the section of the genus in which the scutellum is not distinguishable.

Genus Torneuma, nov. gen.

Corpus parvum, fusiformi-ovatum, subtus late longitudinaliter im-

pressum (aut potius per meso- et meta-sterna et abdominis basin leviter concavum), ubique dense scabroso-subrugulosum, sed haud setosum: *capite* parvo, in cavo prothoracico usque ad rostri basin omnino recondito; *oculis nullis*; *rostro* longiusculo subarcuato tenui (*i. e.* horizontaliter compresso, subtus fere concavo), lineari, sed basin versus leviter rotundato-dilatato et superne ad basin ipsam quasi capiti articulato, in canaliculam pectoralem valde profundam argutissime determinatam (usque ad coxas pedum intermediorum extendentem) arcte applicando; *scrobe* profunda subrecta ad latera rostri posita necnon ad basin ipsam ejus ducta atque ibidem abrupte terminata: *prothorace* subovato basi truncato, longe intra apicem leviter coarctato, antice paulo acuminato: *scutello* haud observando: *elytris* subellipticis connatis: *alis* obsoletis. *Antennæ* longiusculæ, subgraciles, ante medium rostri insertæ: *scapo* longiusculo clavato subrecto; *funiculo* 7-articulato, art° 1° paulo longiore vix latiore, reliquis longitudine subæqualibus latitudine vix crescentibus; *capitulo* oblongo 4-annulato. *Pedes* robusti, contractiles, *antici* ad basin leviter, *intermedii* latius et *postici* latissime distantes: *femoribus* muticis: *tibiis* subrectis, apicem versus (præsertim externum) pilosis, ad apicem in uncum deflexum productis: *tarsis* omnino pseudotetrameris, sed unguiculis minutissimis.

A *τόρνευμα*, quasi torno efformatum.

The unique specimen from which the above characters have been compiled is one of the most anomalous of the Madeiran Coleoptera which have been hitherto detected; nor was it at first sight at all evident to what immediate section of the *Curculionidæ* it should be assigned. After a careful consideration, however, of the various details of its structure, I am satisfied that it is not very remote in affinity from *Acalles* (although so different in its general facies and unclothed surface), and that, when placed at the end of the *Cryptorhynchides* (in the vicinity of *Tychius*, which commences the next subfamily of the *Erirhinides*), it will not be far distant from its natural location. Indeed, in the outline of its prothorax and elytra, and in its robust and basally distant legs, as well as in the excessively deep and abruptly-defined pectoral groove for the reception of its rostrum when inflexed, it has much in common with *Acalles*; nevertheless, in its very small head, which is *completely* concealed beneath the anterior portion of the pronotum (the *rostrum alone* being perceptible when the insect is viewed from above), as well as in its total want of eyes (which, indeed, would have been useless to it, as they would have been altogether immersed within the prothoracic cavity), and the remarkable form of its basally-rounded rostrum, which has all the appearance of being *articulated on* to the head, and of being suddenly constricted (though this is not the case in reality) at its junction with the latter, it

possesses a combination of features essentially its own. Its most extraordinary character, however, is certainly the construction of its rostrum, which has the appearance of being a separate piece,—as it were *turned with a lathe* [a circumstance which has suggested its generic name], and implanted into the fore portion of the head; and it is *on account of* its seeming thus separate, and of its being rounded off at its base, that it looks, at first sight, as though it were suddenly constricted at its point of contact with the head.

Torneuma cæcum, n. sp.

T. fusco-piceum, subopacum et granulis crebris maximis valde depressis scabrosis obsitum; rostro nitidiore, rufo-ferrugineo, carinato, utrinque parce et profunde longitudinaliter punctato; elytris levissime striatis et (oculo valde armato) parce ac brevissime longitudinaliter setulosis; antennis rufo-testaceis, pedibus vix dilutioribus.

Long. corp. lin. $1\frac{1}{3}$.

Habitat Maderam, sub trunco quodam prolapso in "Curral das Freiras" mense Decembri A.D. 1858 a meipso lectum.

T. dull brownish-piceous and nearly opake, densely beset all over with very large and exceedingly depressed scale-like granules (of much the same character as those of the *Tarphii*). *Rostrum* rufo-ferruginous and more shining than the rest of the surface, keeled down the centre, and roughly (but sparingly and irregularly) punctured on either side. *Prothorax* subovate and rather acuminated anteriorly, and quite free from any appearance of pile. *Elytra* subelliptic, most lightly (and not very regularly) striated, and (beneath the microscope) with longitudinal series of very short, most minute, distant, and decumbent paler hairs. *Body beneath* densely scabrous, but scarcely punctured. *Antennæ* rufo-testaceous. *Legs* slightly setose, but hardly paler than the rest of the surface.

Captured by myself, adhering to the underside of the trunk of a felled cherry-tree, which was lying on the damp ground, at the bottom of the Curral das Freiras, during my encampment there, with the Rev. R. T. Lowe, on the 9th of December 1858.

(Subfam. BRACHYDERIDES.)

Genus STROPHOSOMUS.

(Billberg) Schön., Curc. Disp. Meth. 97 (1826).

Strophosomus Coryli, Fab.

S. niger, squamis cinereo-brunneis dense tectus; oculis subconicis,

prominulis; elytris parce setosis, sutura antice nigra (squamis carentibus); antennis rufo-ferrugineis; pedibus rufo-piceis.
Long. corp. lin. 2.
Habitat Maderam australem, a Dom. Moniz detectus.

Curculio Coryli, Fab., Syst. Ent. 148 (1775).
Strophosomus Coryli, Steph., Ill., Brit. Ent. iv. 126 (1831).
Cneorhinus Coryli, Schön., Gen. et Spec. Curc. i. 535 (1833).

S. black, but densely clothed with brown, or brownish-cinereous, scales. *Rostrum* short and thick, but a little attenuated anteriorly; with the *eyes* somewhat conical, and very prominent. *Prothorax* rugulose, and with a narrow and lightly-impressed dorsal channel. *Elytra* convex and rounded, but with their sides rather straightened, or parallel, about the middle, being somewhat suddenly rounded inwardly about the shoulders; distinctly punctate-striate, and rather coarsely (though sparingly) pubescent, or setose, especially behind; and with the basal portion of the suture black—being denuded of scales. *Antennæ* rather slender, and rufo-ferruginous. *Legs* robust, rufo-piceous, and more or less clothed with scales.

A single specimen of the common European *S. Coryli* has been communicated to me by Mr. Bewicke, who received it from Senhor Moniz, by whom it was captured near Funchal. It differs in no respect, so far as I can perceive, from the ordinary examples of more northern latitudes,—from whence, indeed, it is not improbable that it may have been accidentally imported into the island.

Fam. Attelabidæ.

Genus Ramphus.

Clairville, Ent. Helv. i. 104 (1798).

Ramphus æneus, Schön.

R. ovatus, ænescenti-niger, subnitidus; capite prothoraceque creberrime et profunde punctatis; elytris crebre punctato-striatis; antennis brevibus, testaceis, clava acuminato-ovata nigra.
Long. corp. (rostro excepto) lin. $\frac{2}{3}$–1.
Habitat in foliis pomorum in cultis supra Funchal, a Dom. Bewicke copiose repertus.

Ramphus æneus, Dej. in Cat.
—— ——, Schön. Gen. et Spec. Curc. i. 310 (1833).

R. ovate, brassy-black, free from pile, coarsely alutaceous and subrugulose all over, and slightly shining. *Head* and *prothorax* very densely and deeply punctured: the *former* (as in the ordinary *Ramphi*) greatly inflexed, with the rostrum applied closely to the breast, and with the eyes large and meeting on the forehead: the *latter* much narrowed anteriorly, and rather less

closely punctured in the centre of its disk than elsewhere. *Elytra* regularly, closely, and rather deeply punctate-striate. *Antennæ* testaceous, with their club (which is acute at its apex) black.

Although not according *precisely* with the diagnosis of the *R. æneus* as given in Schönherr's 'Genera et Species Curculionidum' [which, moreover, is there stated to be *smaller* than the common *R. pulicarius*, whereas the Madeiran insect is, on the average, considerably larger], the little *Ramphus* described above is nevertheless, I think, sufficiently near to it to warrant the conclusion that it is specifically identical; and more particularly so, since the recorded *habitat* of the *R. æneus* is the south of France, and Portugal. Although exceedingly variable in stature, the long array of specimens from which I have drawn my description differ from the *R. pulicarius* in being, on the average, decidedly larger and of a more or less evidently brassy tinge, in their alutaceous sculpture being coarser, their punctuation, especially of the head and prothorax, much more dense, and their antennæ (in proportion to the size of the insect) perceptibly shorter and entirely testaceous *except the club*,—which last is rather more abbreviated and abrupt, and less acuminated at its apex, than is the case with that species. It was detected, abundantly, by Mr. Bewicke, on the leaves of apple- and pear-trees, in the cultivated grounds above Funchal (from his Quinta at the Palmeira up to almost the elevation of the Mount Church), where, under his guidance, it was subsequently captured by myself also.

Fam. **Bruchidæ.**

Genus Bruchus.

Geoffroy, Hist. Abr. des Ins. de Paris, i. 163 (1762).

Bruchus Pisi, L.

B. ovato-oblongus, niger, pube fulvescente et albida variegatus; prothorace transverso, ad latera in medio distincte spinoso; elytris subparallelis crenato-striatis, fascia postmedia interrupta albida ornatis; antennarum basi, tibiis tarsisque anterioribus plus minus dilute rufo-testaceis, femoribus posticis longe et acute dentatis.

Long. corp. lin. $2\frac{1}{2}$.

Habitat Maderam, a Dom. M. Park prope Funchal captus.

Bruchus Pisi, Linn., Syst. Nat. 1. ii. 604 (1767).
—— ——, Schön., Gen. et Spec. Curc. i. 57 (1833).
—— ——, Lucas, Col. de l'Algérie, 401 (1849).

B. like the *B. rufimanus*, but rather larger and more oblong. *Prothorax* altogether broader and less narrowed behind, with the lateral angle developed into a distinct central spine, and with the paler patch towards the middle of the hinder margin usually

larger and more conspicuous. *Elytra* rather more parallel at the sides than in that insect, with the interstices more evidently punctured, and with the white spots larger and more confluent —forming a more or less conspicuous (though broken) fascia on each behind the middle. *Pygidium* more variegated than in the *B. rufimanus,* the two black patches at the apex being larger. *Antennæ* rather short and very robust; their *base,* as well as the *front tibiæ* and *tarsi,* the *apical portion* (sometimes the whole) of the *intermediate tibiæ,* and the *intermediate tarsi* dull rufo-testaceous. *Hinder femora* with a very large and acute tooth beneath.

The distinctions between the *B. Pisi* and the common *B. rufimanus* will be at once gathered from the above comparative diagnosis. I find a single example among some old insects collected by Mr. M. Park near Funchal; and four more were communicated to me a year ago by the Barão do Castello de Paiva, amongst a quantity of common and ordinary species stated to have been taken at Caniçal. It is abundant in the Canaries (as it is throughout central and southern Europe and the north of Africa), where I have brushed it from out of the pea-fields in at least three of the islands; and it will probably be found equally common in such localities in Madeira also.

Fam. Halticidæ.

Genus Longitarsus.

Latreille, Fam. Nat. du Règne Anim. 405 (1825).

Longitarsus abdominalis, Dufts.

L. ovatus, convexus, subnitidus, rufo-ferrugineus; capite, antennis (breviusculis) apicem versus necnon apice femorum posticorum picescentibus; elytris minus rufescentibus, levissime subseriatim punctatis.

Long. corp. lin. vix $\frac{7}{8}$.

Habitat in graminosis Maderæ, æstate 1855 a meipso detectus.

Haltica abdominalis, Dufts., Fna. Austr. iii. 262 (1825).

L. ovate, convex, slightly shining, and reddish-ferruginous. *Head* of a darker, or more piceous hue than the *prothorax,* which is very lightly and obscurely subpunctulated. *Elytra* a little paler than the prothorax, and regularly ovate, being rounded inwards towards the shoulders; very finely, but more perceptibly punctured than the prothorax, the punctures having the slightest possible tendency to be disposed in longitudinal rows; and with the suture a trifle darker than the rest of the surface. *Antennæ* rather short; dusky towards their apex; their *base,* the *four anterior legs,* and the *two hinder tibiæ* and *tarsi,* testaceous.

Three specimens of this insect I had inadvertently mixed up,

in my collection, with the examples of *L. nubigena*; and it was not until M. Allard (to whom I lately transmitted my Madeiran and Canarian *Halticidæ* for revision) pointed out to me their distinctive characters, that I became aware of my mistake. It may be at once recognized from that species by its rather smaller size and more ovate form (its humeral angles being much more rounded off), as well as by its shorter antennæ, less prominent eyes, more lightly punctured surface, and somewhat less pallid hue. My specimens were taken by brushing the grass, on a sloping bank, about two-thirds of the way up the Ribeira de St. Lusia, in the summer of 1855.

Fam. Chrysomelidæ.

Genus Chrysomela.

Linnæus, Syst. Nat. edit. i. (1735).

Chrysomela onychina.

C. elliptico-ovata, nitida, viridi-splendens; capite prothoraceque fere impunctatis, hoc ad latera late subemarginato; elytris minute sub-biseriatim punctulatis, apicem versus in medio subnodoso-convexis et lateraliter compressis, utrinque latera versus longitudinaliter costatis necnon intra marginem valde corrugate-rugosis.

Long. corp. lin. $5\frac{1}{2}$.

Chrysomela Fragariæ, Woll., Ins. Mad. 458, tab. ix. f. 7 (1854).
—— ——, Woll., Cat. Mad. Col. 135 (1857).

Although at all times exceedingly unwilling to alter a specific title (a step which should never be taken without the strongest and most cogent reasons), I have nevertheless given a fresh diagnosis of the Madeiran *Chrysomela*, feeling the absolute necessity of imposing on it a new name. The constant rediscovery, now, of this rare and curious insect on the *Bystropogon*, and on no other plant whatsoever, would certainly imply that it is essentially peculiar to it; and hence there can be no doubt that the three specimens which I originally detected (in August 1850) on the leaves of the Mountain Strawberry, were merely accidental ones, which had fallen from off the bushes of *Bystropogon* growing on the rocks immediately above them: so that to persist in retaining for it the trivial name of *Fragariæ* (which I unfortunately adopted without sufficient evidence), would be nothing more or less than to perpetuate an erroneous impression of its habits. I therefore consider that it is not only desirable, but absolutely *necessary*, to substitute a fresh name; and I have consequently done so by giving it a more appropriate one, suggested by its remarkable analogy, in general outline and anomalous posterior contractions, to a *hoof*.

[To be continued.]

XLIX.—*On new Land-Shells from Darjiling, with a series of new Indian Species of* Achatina. Described by W. H. Benson, Esq.

Diplommatina Blanfordiana, B.

Testa dextrorsa, foveato-rimata, ovato-acuminata, confertim arcuato-costulata, albida, spira ovato-pyramidata, superne attenuata, apice acutiusculo, sutura impressa; anfractibus $7\frac{1}{2}$ convexis, antepenultimo majusculo tumido, ultimo antice ascendente; apertura subverticali, late auriculari, plica columellari valida nutante munita, peristomate expanso, extus varice retrorelicta remotiuscula valida aucto, infra ad sinistram subangulato, marginibus callo parietali crasso expanso appresso junctis, columellari leviter sinuato. Operc. —— ?

Long. $4\frac{1}{2}$, diam. $2\frac{1}{3}$ mill.

Habitat prope Darjiling. Teste W. T. Blanford.

Independently of its smaller size and stronger costulation, this shell is distinguished from *D. pachycheilus* by its foveate rimation behind the thin columellar lip, and by the retrorelict variciform second peristome, which is remote in its course, on the right side, from the thin actual peristome, but joins it below the umbilical cavity. In *D. pachycheilus* the peristome is thickened and bifurcate at the insertion of the outer lip, and there is no remote varix; while the incrassate columellar lip is reflected over the rimation, and entirely conceals it. The last whorl ascends more conspicuously in front than in *D. pachycheilus*, although it rises considerably also in that shell—a feature which I omitted in the description given in the 'Annals' for 1857. The costulation of *D. pachycheilus* is very variable; in some specimens it disappears on the lower whorls, in others on the upper ones only; occasionally it pervades the surface.

The following characters may be added to those already given of *D. pachycheilus*:—

Anfractu ultimo antice ascendente; peristomate superne ad angulum bifurcato, margine columellari externe callo expanso irregulari appresso, periomphalum obtegente, munito.

It is found among dead leaves with *D. Blanfordiana*.

Ennea stenopylis, B.

Testa longe curvato-rimata, cylindraceo-ovata, arcuatim costulata, sub epidermide cereo-cornea albida; apice conoideo-obtuso, sutura impressa; anfractibus 6 angustis, convexiusculis, ultimo minore compresso, antice leviter ascendente, latere dextro antice substrangulato, valde scrobiculato, basi anguste compressa; apertura verticali, subaxiali, triangulari-obovata, subcordiformi, $\frac{1}{3}$ testæ superante, peristomate undique expanso calloso reflexiusculo, margine dextrali superne profunde sinuato, plica angulari parietali valida, superne sub-bicruri, margines peristomatis jungente, subtus lamel-

liformi profunde intrante, denteque palatali unica intus longe et contigue concurrentibus, aperturam coarctatam inæqualiter oblique dividentibus, aream minorem quasi perforatam prope sinum dextralem, ab area sinistra majore ovato-oblonga, secernentibus.
Long. $3\frac{1}{2}$, diam. $1\frac{1}{2}$ mill.
Habitat in vallibus Rungnu et Rimmau (alt. 4000 ped.) prope Darjiling. Detexit W. T. Blanford.

Although differing so much in form from *Ennea vara*, B., of the Khasia Hills, this shell is nearly allied to it in the formation and dentation of the aperture; the characters are, however, on a more exaggerated scale. The Cape *Pupa Layardi*, B., in its parietal and upper palatal plicæ, approaches the structure observable in *E. stenopylis*, in which the plaits meet so closely during their descent as to leave a scarcely visible line of separation, cutting off the sinus at the upper part of the dextral margin so completely as to present an analogy to the basal canal of *Cataulus*. Like *E. vara*, the aperture is deficient in columellar folds. The parietal callus is a modified representation of that of the South Indian *E. Pirriei*, Pfr.

Achatina Hastula, B.

Testa turrito-subulata, tenui, oblique capillaceo-striata, fusco-cornea, nitidula; spira subulata, apice obtuso, sutura profundiuscula; anfractibus 9, primis convexis, postremis convexiusculis, ultimo $\frac{2}{7}$ testæ vix attingente; apertura vix obliqua, ovato-elliptica, peristomatis marginibus callo tenui junctis, dextrali recto acuto, columellari arcuato calloso albido, basi oblique truncata.
Long. $12\frac{1}{2}$, diam. $3\frac{1}{2}$ mill.; long. apert. $3\frac{1}{2}$ mill.
Habitat ad Pankabari, prope Darjiling, raro. Teste W. T. Blanford.

Of a more slender form than the large *Ach. tenuispira*, B., the whorls increasing very gradually, and not attenuate towards the upper part of the spire as in that species.

Achatina Orobia, B.

Testa ovato-oblonga, solidiuscula, lævigata, leviter striata, striis nonnullis remotiusculis profunde impressis sculpta, nitida, olivaceo-cornea; spira convexe pyramidata, apice obtuso, sutura impressa; anfractibus $6\frac{1}{2}$–$7\frac{1}{2}$ convexiusculis, ad humerum angulatis, crenulatis, ultimo $\frac{1}{3}$ testæ superante; apertura verticali semiovali, columella valde arcuata, callosa, basi oblique truncata, peristomate recto, crassiusculo, obtuso.
Long. 11, diam. 5 mill.; apert. 4 mill. longa, 3 lata.
Habitat ad Sinchul et Darjiling (alt. ped. 8500 et 7000). Teste W. T. Blanford.

Distinguished from the larger Khasia species, *A. crassilabris*, B., by its peculiar sculpture, and by the formation of the whorls below the suture.

The following shells are added to complete the history of the known Indian species of *Achatina* :—

Achatina prælustris, B.

Testa ovato-oblonga, pertenui, fragili, irregulariter plicato-striata, nitente, pallide luteo-cornea ; spira pyramidata, apice obtuso, sutura profundiuscula, subcrenulata ; anfractibus $8\frac{1}{2}$ convexiusculis, superne prope suturam tumidiusculis, ultimo $\frac{1}{3}$ testæ superante, subinflato ; apertura verticali, semiovali, latiuscula, columella subrecta, vix curvata, basi oblique truncata, peristomate recto, acuto.
Long. 33, diam. 17 mill. ; apert. 15 mill. longa, 9 lata.
Habitat in provincia Orissa prope Midnapore, Balasore, et Cuttack. Teste W. Theobald.

This is the largest known Indian form of the type to which the Cingalese and Nilgherry shell, *Ach. Ceylanica*, Pfr., belongs. It was found by Mr. Theobald in Mangoe topes, both in the hills and plains.

Achatina Chessoni, B.

Testa ovato-turrita, superne attenuata, scabre plicato-striata, striis minutissimis confertis obsoletis spiralibus decussata, fulvo-cornea, vel purpureo-fusca, translucente, nitidula ; spira turrita, apicem versus obtusiusculum attenuata, sutura impressa, crenulata ; anfractibus $11\frac{1}{2}$ convexiusculis, ultimo $\frac{1}{3}$ testæ superante inflatiusculo ; apertura subverticali, semiovali, latiuscula, columella subrecta, albido-callosa, basi vix oblique truncata, peristomate recto, tenui.
Long. 37, diam. 15 mill. ; apert. 14 mill. longa, 8 lata.
Habitat in montibus Mahabaleshwar. Detexit J. Chesson.

There is also a more slender variety, 33 mill. in length by 12 in breadth.

This fine shell, the largest of the forms intermediate between *Ach. prælustris* of the eastern coast of the Peninsula and the north-eastern *A. Cassiaca*, was found on the high mountain group overlooking the western coast of the Indian Peninsula, south of Bombay, by Mr. J. Chesson. It was accompanied by the following species.

Achatina notigena, B.

Testa elongato-conica, superne attenuata, tenui, subcostulato-striata, fulvo-cornea, nitida, pellucida ; spira turrita, superne attenuata, apice obtuso, sutura impressa, irregulariter crenulata ; anfractibus 9–10 convexiusculis, ultimo $\frac{1}{3}$ testæ non attingente ; apertura subverticali, anguste semiovali, columella vix arcuata, subverticali, basi suboblique truncata, peristomate recto, tenui, marginibus callo tenui junctis.
Long. 20, diam. 7 mill. ; apert. 6 mill. longa, vix 4 lata.
Var. inflatior, ovato-turrita, long. 22, diam. 8 mill.
Habitat in montibus Mahabaleshwar cum præcedente, teste J. Chesson ; necnon prope Bombay, W. Theobald.

This shell has relations to *Ach. Chessoni* in the attenuation of

the spire towards the summit,—a feature observable also in the north-eastern *A. tenuispira*. It differs in form, size, proportions, &c. In one specimen from Bombay, the attenuation of the spire is less conspicuous.

Achatina Sarissa, B.

Testa elongato-conica, tenui, lævigata, striatula, anfractibus ultimis sub lente confertim obsolete decussatis, nitidissima, olivaceo-cornea; spira elongato-pyramidata, apice obtuso, sutura impressa; anfractibus $9\frac{1}{2}$ convexiusculis, ultimo $\frac{2}{7}$ testæ superante; apertura subverticali, ovato-elliptica, columella obliqua, leviter arcuata, albido-callosa, basi oblique truncata, peristomate recto, tenui.
Long. 16, diam. $5\frac{1}{2}$ mill.; apert. 5 mill. longa, $3\frac{1}{2}$ lata.
Habitat prope Comercolly, Bengaliæ, ad ripas fluminis Gangis. Detexit Dr. Theodore Cantor.

I am indebted to Dr. Cantor for this interesting addition to the few species which inhabit the plains of Lower Bengal.

Achatina Pyramis, B.

Testa oblongo-turrita, solidula, lævigata, striatula, nitida, luteo-cornea; spira turrita, lateribus convexiusculis, apice obtusiusculo, sutura impressa; anfractibus 8, convexiusculis, ultimo $\frac{1}{3}$ testæ æquante, antice obsolete plicato; apertura subverticali, elliptico-semiovali, columella arcuata, callosa, basi oblique truncata, peristomate recto obtuso, intus albido-labiato.
Long. 15, diam. 6 mill.; apert. 5 mill. longa, $2\frac{1}{2}$ lata.
Habitat ad Teria Ghât Montium Khasia. Detexit W. Theobald.

Allied to the smaller *Ach. crassula*, B., from Darjiling, but distinguished from it by its colour, smoother sculpture, more convex and numerous whorls, by the characters of the peristome, and by the convex and not planate sides of the spire.

A large variety of *Ach. crassula*, collected by Mr. W. T. Blanford near Darjiling, is 12 mill. in length by $5\frac{1}{2}$ in breadth, and, like the type, possesses only seven whorls.

Achatina Scrutillus, B.

Testa oblonga, solidiuscula, lævigata, subremote striatula, nitidula, fulvo-cornea; spira ovato-oblonga, apice obtuso, sutura impressa; anfractibus $5\frac{1}{2}$ convexiusculis, ultimo $\frac{1}{3}$ testæ superante; apertura verticali, ovato-elliptica, columella valde arcuata, basi subito et profunde truncata, peristomate recto, obtuso, marginibus callo crassiusculo junctis.
Long. 6 mill., diam. $2\frac{2}{3}$; long. apert. $2\frac{1}{2}$ mill.
Habitat in Provincia Orissa (Cuttack), necnon in valle superiore fluminis Nerbuddæ, Indiæ Centralis. Detexit W. Theobald.

This little species may be at once known on comparison with the Bengal *Ach. Gemma*, B., which is ordinarily of the same

size, by its less rapidly decreasing spire, solidity, and colour; and from the paler *A. Frumentum*, Reeve, which is probably only a local variety of *Ach. Gemma*, by the two first-mentioned characters.

I have a large variety of *A. Gemma*, collected by Dr. Bacon, which attains a length of 8 mill. by 3½ in breadth.

A single specimen of *Achatina Amentum*, B., 24 mill. in length, and with nine whorls, was found by Mr. W. Theobald in the Valley of the Upper Nerbudda. It is not in good condition, the upper whorls being bleached; but the form and sculpture leave little room for doubt as to its identity with the Calcutta species, which is exceedingly rare, three specimens only having been taken by me in a living state twenty-five years ago. They were under a felled palm-tree (*Borassus flabelliformis*) on the Howrah bank of the river, between the Bishop's College and the Botanic Gardens. The late Dr. Pearson believed that he had found the young shell, 2 lines in length, at Alipore, near Calcutta. Search should be made for the species within the cool and moist bases of the fronds of Palmyra, Cocoa-nut, and other Palms.

An undescribed *Achatina* occurs in the Mahabaleshwar Hills, nearly related to *A. Ceylanica*, Pfr., but differing from it in its acuminate summit. The single specimen found by Lieut. Arthur E. Benson is in too decayed a state for description. Its length is 15 mill., and diameter 8 mill. Another smaller shell, of a similar type, and with the summit less pointed, was taken by Mr. Theobald at Teria Ghât, in the Khasia Hills. It is probably a new species; and the examination of a perfect shell is desirable. With it Mr. Theobald found a small solid form, in a bleached condition, which appears to be a dwarf variety of *A. crassilabris*, B., 11 mill. in length by 6 in diameter.

A weathered and imperfect *Achatina*, sent by Mr. Theobald from Orissa, resembles the Nilgherry *A. Oreas*, B., when of immature growth. I have a pale variety of *A. Oreas* from M. Petit, which was stated to have been received from Bombay. It accords with the mountain type in all but colour.

In Burmah Mr. Theobald got a variety of *A. tenuispira* on the banks of the Irawady, and at Phie Thán the young of a reversed species, which is doubtless new. An adult specimen is a desideratum. The young presents from three to four smooth hyaline whorls, with a distinct truncation at the base. The shell figured in 'Conchologia Iconica' as *Bulimus Sikkimensis*, Reeve, proves to be an extremely young specimen of a fine *Spiraxis*, of which an example with seven whorls, obtained at Darjiling by Mr. W. T. Blanford, measures 27 mill. in length by nearly 10 in diameter.

The following list exhibits the names and localities of all the Continental-Indian species of *Achatina* which have hitherto been described:—

A. tenuispira, B. Khasia Hills, Darjiling, and Burmah.
— *Cassiaca*, B. Khasia Hills.
— *crassilabris*, B. „
— *Pyramis*, B. „
— *crassula*, B. Darjiling.
— *Hastula*, B. „
— *Orobia*, B. „
— *Amentum*, B. Lower Bengal and Nerbudda.
— *Sarissa*, B. „
— *Gemma*, B. „
— *Frumentum*, Reeve. „ (Var. of *Gemma*.)
— *prælustris*, B. Orissa.
— *Scrutillus*, B. Orissa and Nerbudda.
— *Chessoni*, B. Mahabaleshwar Hills.
— *notigena*, B. Mahabaleshwar Hills and Bombay.
— *Oreas*, B. Nilgherries and Bombay.
— *Perrotteti*, Pfr. (*Nilagirica*, B.). Nilgherries.
— *Jerdoni*, B. Nilgherries.
— *Ceylanica*, Pfr. (*Orophila*, B.) Nilgherries.
— *Bensoniana*, Pfr. Nilgherries.
— *Shiplayi*, Pfr. „
— *corrosula*, Pfr. „
— *Balanus*, B. Banks of Jumna.

Cheltenham, April 28, 1860.

Supplementary Notice, containing Descriptions of two new Species of Achatina *from the Nilgherries.*

The two following species, which should have been included in my paper on Indian *Achatinæ*, were inadvertently omitted:—

Achatina Botellus, B.

Testa oblonga, solidiuscula, lævigata, leviter striatula, sub lente indistincte confertim, spiraliter, minutissime acuducta, polita, fulvo-castanea; spira ovato-oblonga, apice valde obtuso, sutura impressa, leviter crenulata; anfractibus 7 convexiusculis, ultimo vix latiore; apertura subobliqua, semiovali, intus albida, columella valde arcuata, albido-callosa, basi subverticaliter truncata, peristomate recto, marginibus callo tenui junctis, dextrali latiusculo, planato, non incrassato.

Long. 18, diam. $7\frac{1}{2}$ mill.; apert. 7 mill. longa, $3\frac{2}{3}$ lata.
Habitat in montibus Nilgherries. Detexit T. Jerdon.

A single specimen of this very distinct species was received from Dr. Jerdon with the following.

Achatina Facula, B.

Testa turrito-ovata, tenui, lævigata, irregulariter striatula, translucente, nitida, pallide fulvo-cornea; spira turrito-conica, apice obtuso, sutura profundiuscula, irregulariter vix crenulata; anfractibus $7\frac{1}{2}$, subconvexis, ultimo $\frac{2}{5}$ testæ vix attingente, antice leviter remote plicato-striato; apertura subverticali, semiovali, columella breviter valde arcuata, callosa, basi oblique truncata, peristomate recto, tenui, marginibus callo tenui junctis.

Long. 18, diam. 8 mill.; apert. 7 mill. longa, $4\frac{1}{2}$ lata.

Syn. *Ach. Perrotteti*, Conch. Icon. pl. 21. f. 102, nec Pfr.

Habitat in montibus Nilgherries, T. Jerdon.

Intermediate in form between *A. Oreas* and *A. Hügeli*, Pfr., this shell was, in the 'Conchologia Iconica,' confounded with *A. Perrotteti*, Pfr., which proved to be a more elongated form, of which *A. Nilagirica*, B., fig. 87 of the same plate, is a lengthened variety. Pfeiffer cites fig. 102, with a mark of doubt, under *A. Perrotteti*, in the third vol. of his Manual.

The number of Nilgherry species of *Achatina* now amounts to nine, or two less than those described from the Island of Ceylon.

May 1, 1860.

Note. An *Achatina*, described (without a name) by Capt. T. Hutton in the 3rd vol. of J. A. S. Calcutta, was found by him between Mhow and Nimuch. It equals *A. tenuispira* in length, and appears to be a distinct species.

L.—*On the Nomenclature of the* Foraminifera.

By W. K. Parker, M. Micr. Soc., and T. R. Jones, F.G.S.

[Continued from p. 298.]

19. Spirolina, Ann. Mus. v. p. 244; Hist. An. s. Vert. vii. p. 601. Spirolinites depressa. Ann. Mus. v. p. 245; viii. p. 62, f. 14; Hist. An. s. Vert. vii. p. 602, No. 1. "Fossil; Grignon."

This is a *Peneroplis planatus*, F. & M. sp. The right-hand figure is nearly orbicular, and may represent a *Peneroplis* in its Dendritine condition; the other is more complanate, with outspread chambers.

20. Spirolinites cylindracea. Ann. Mus. v. p. 245. No. 2; viii. pl. 62. f. 15; Tabl. Enc. Méth. pl. 465. f. 7 *a–c*, and pl 466. f. 2 *a*, *b*; Hist. An. s. Vert. vii. p. 603, No. 2. "Fossil; Grignon."

Endless modifications of the constricted and crozier-like forms*

* *Spirolina stenostoma*, Deshayes (in Lyell's 'Principles,' pl. 4. f. 15-18, and 'Manual,' 5th edit. fig. 237), is one of these lituate varieties, narrow and somewhat flattened.

of *Peneroplis* (scarcely two alike) are to be found in the Grignon Tertiary deposits, and also, at the present day, in the deeper waters of warm latitudes. The broad nautiloid *Peneroplides* indicate shallow water.

Some of the Grignon deposits appear to have been formed in shallow water; other beds are such as may be met with in the Red Sea, at from 300 to 500 fathoms. Those beds, however, that are rich in large specimens of *Foraminifera* have their parallel very exactly in the deposits of the coral-lagoons and reef-margins of the Australian Seas.

21. Spirolinites cylindracea, β. Ann. Mus. v. p. 245; viii. pl. 62. f. 16 *a, b.*; Tabl. Enc. Méth. pl. 466. f. 3 *a, b*; Hist. An. s. Vert. vii. p. 603. "Fossil; Grignon."

This has no relationship with the foregoing. It is a variety of another and very distinct species, and is of extreme interest among Foraminifers, being, as it were, an uncoiled and almost uniserial, dimorphous form of *Valvulina triangularis,* D'Orb. The typical form of *V. triangularis* is a triserial, three-sided, pyramidal shell, taking three cells to make a turn of its spire, and having its aperture furnished with a peculiar tongue-like flap or valve, as seen in D'Orbigny's Model No. 25.

Valvulina has a sandy shell. Many Foraminifers figured and described by authors as *Valvulinæ* are *Rotaliæ.* Some of the regular forms of *V. triangularis* closely resemble *Verneuilina tricarinata* (a subspecific form of *Textularia agglutinans*).

When the trifacial compression of the shell becomes obsolete, a close approach is made to *Textularia Trochus,* which, however, has but two cells in one turn of the spire. A small specimen of this variety is figured by us in the Ann. Nat. Hist. 2 ser. xix. pl. 11. f. 15, 16. This trochoid form of *Valvulina* is sometimes extremely depressed, and becomes scale-like and flat, resembling some *Rotaliæ.* Williamson has described and figured such a form under the name of *Rotalina fusca,* Monogr. p. 55, pl. 5. f. 114, 115.

Other varieties, on the contrary, widely differ in shape, the triangular portion being obsolete, and the several chambers of which the shell is composed, failing to make one coil of the spire, form an obliquely semioval shell, having a broad, flat, oblique septal plane, with a large valve. This valve, sending processes of shell-matter over the great crescentic aperture, converts the usually simple passage into a semilunar series of subquadrate passages. Here we have an isomorph of *Bulimina variabilis,* D'Orb. Our specimens are undescribed, and come from the Norwich Chalk and the Grignon Tertiary; some also occur recent in Australia.

V. triangularis has sometimes a tendency in its later cham-

bers, after having developed the triangular portion, to become dimorphous, taking on a new character of growth—namely, that seen in *Bulimina*, where several oblong parallel cells are taken up in the formation of the round advancing coil. Specimens showing the combination of Verneuiline and Bulimine growth occur fossil at Grignon and recent in Australia. In many specimens, however, the triangular growth is masked, and the peculiar valve of the aperture is required to aid us in discriminating the varieties of *Valvulina* from those of *Bulimina*. Such a one is the *V. gibbosa*, D'Orb. (Mém. Soc. Géol. France, iv. p. 38, pl. 4. f. 1, 2).

Besides these short and variously coiled *Valvulinæ*, there are others, taking long or claviform shapes, resembling nails. Of these elongate varieties one is figured in Lyell's 'Principles of Geology,' pl. 4. f. 12–14, and 'Manual,' 5th edit. f. 239 (*Clavulina corrugata*, Desh.). The valve is well shown in the drawing, and the chambers may be seen to pass from a triserial to a uniserial arrangement, still fitting obliquely on each other. Between this and the typical *V. triangularis* there is a regular series of gradation. A neater form than *C. corrugata* is the *C. Parisiensis*, D'Orb. (Modèles, No. 66); in the specimen modelled, the large round terminal aperture has accidentally lost its valve-like process. The chambers of the produced part are here conformably adapted one to another, and there is a marked distinction between the triserial and uniserial portions. Subvarieties of this form are common, not only in the Grignon deposits, but also recent in the Indian and Australian seas.

A modification of *Valvulina* nearly allied to *C. Parisiensis* is the *C. angularis*, D'Orb., Ann. Sc. Nat. vii. p. 268, pl. 12. f. 7 (figured also as *C. tricarinata*, D'Orb. For. Cuba, pl. 2. f. 16–18). This variety, which also is an inhabitant of the eastern seas, differs mainly from the last in attaining a much larger size, and in keeping a tricarinate form throughout its length. A still nobler *Clavulina*, but having five carinæ along its uniserial portion, is common in company with the last two in the shelly deposits of the coral-reefs of Australia.

The specimen figured by Lamarck is a long *Clavulina* closely related to those above mentioned; but it presents us with an extreme development of the uniserial chambers, the coiled portion being nearly obsolete. By D'Orbigny this shell is named *Nodosaria* (*Orthocerina*) *Clavulus* (Ann. Sc. Nat. vii. p. 255), and is represented by his Model No. 2. This model fails to exhibit the slightly coiled commencement, which is constant in this variety, and some traces of which may be recognized in Lamarck's sectional view of the shell (Tabl. Enc. Méth. pl. 466. f. 3 *b*). This is a common Foraminifer at Grignon.

The name *V. triangularis* is well adapted as a specific appellation, including all the many varieties here indicated, because a tendency to triangularity is continually showing itself in some degree or other in most of the forms, however aberrant.

There are many other Clavuline forms of *Foraminifera* besides those belonging to *Valvulina*. For instance, some arise out of *Textularia*, others out of the Verneuiline subspecies, and others from *Uvigerina*. The claviform varieties of *Textularia* (biserial in their commencement) have been classed by D'Orbigny as *Bigenerinæ*, including *Gemmulina*. Those related to *Verneuilina*, which have a triserial arrangement at first (whether inflated or angular), have been classed by D'Orbigny under his genus *Clavulina*; and of these *C. communis*, D'Orb., is a good example. The Uvigerine *Clavulinæ* are exemplified by *Uvigerina nodosa*, var. *β*, D'Orb., Ann. Sc. Nat. vii. p. 269; Sold. Test. ii. pl. 4. fig. *g*.

22. Miliola*. Ann. Mus. v. p. 349. Lamarck possessed many specimens of *Miliolæ* from the Mediterranean and from the Calcaire grossier of Paris. The fossil forms he termed *Miliolites* † (*op. cit.* p. 351). As there is no generic distinction between the recent and fossil forms, the name *Miliola* ‡ is sufficient.

In a paper in the 'Microscopical Transactions' (Quart. Journ. Microsc. Sc. No. 23) the *Miliolæ* are shown to comprise a vast number of forms not susceptible of specific limitations among themselves; although, for the sake of convenience, the names *Uniloculina, Biloculina, Triloculina, Quinqueloculina, Spiroloculina, Cruciloculina, Hauerina, Allomorphina, Adelosina*, and others are more or less serviceable as subsidiary terms for the different subspecific groups. We have already noticed that *Miliola* (*Quinqueloculina*) *Seminulum*, Linn., is the type-species (Ann. Nat. Hist. 3 ser. iii. p. 480).

The *Miliolæ* belong to the "Agathistègues" of D'Orbigny, and the *Plicatilia* of Ehrenberg. They form an important group among the "opake-shelled" *Foraminifera*.

Miliolites ringens. Ann. Mus. v. p. 351, No. 1; ix. pl. 17. f. 1; Hist. An. s. Vert. vii. p. 612, No. 1. "Fossil; Grignon."

This is a *Biloculina*, abundant both in the Tertiary and the present seas. Its best development is on sandy and clayish bottoms, at from 30 to 100 fathoms. D'Orbigny figures very fine specimens in the 'For. Foss. Vien.' and in other Monographs,

* Thus called by Lamarck from the resemblance to a millet-seed (*Panicum miliaceum*), *loc. cit.* p. 850.

† Denys de Montfort subsequently applied this term to an *Alveolina* (Conch. Syst. i. p. 174).

‡ Some authors have modified this term, making it "Miliolina," to be in harmony with the majority of D'Orbigny's generic appellations.

under various names. This is the *B. bulloides*, d'Orb., Ann. Sc. Nat. vii. p. 297; Modèles, No. 90; also the *Pyrgo lævis*, Defrance, Dict. Sc. Nat. Zool. pl. 88. f. 2, 2 *a*, 2 *b*.

23. Miliolites Cor-anguinum. Ann. Mus. v. p. 251, No. 2; ix. pl. 17. f. 3 *a–c*; Hist. An. s. Vert. vii. p. 612, No. 2. "Fossil; Grignon" (and Fontenai-Saints-Pères, near Mantes, according to Defrance, Dict. Sc. Nat. xxxi. p. 68).

A well-developed form of *Triloculina*, of considerable size and well grown. This is one of the most globular of the trigonal varieties. It may be found in most warm seas, at no great depth. It is common in the Tertiary deposits.

One of Lamarck's figured specimens appears to be ornamented with striæ or with riblets.

24. Miliolites trigonula. Ann. Mus. v. p. 351, No. 3; ix. pl. 17. f. 4; Hist. An. s. Vert. vii. p. 612, No. 3; *M. Cor-anguinum*, Tabl. Enc. Méth. pl. 469. f. 2 *a, b, c*. "Fossil; Grignon."

This is the same as *Triloculina Cor-anguinum*, except that the sides are less convex, the lobes or segments of sarcode being thinner. It is represented by D'Orbigny's Model No. 93.

Modified forms with flattened and even hollowed sides (such as *T. tricarinata*, d'Orb. Modèles, No. 94) are frequently met with.

Besides the smooth varieties, there are many others of the same shape, but having ribbed or pitted surfaces.

As the *T. trigonula* is copied in the 'Tabl. Enc. Méth.,' and there termed *T. Cor-anguinum*, it is evident that Lamarck recognized the close relationship of these two forms.

25. Miliolites planulata. Ann. Mus. v. p. 352, No. 4; Hist. An. s. Vert. vii. p. 613, No. 4. Three varieties. "Var. *a*, fossil, from Louvres, near Paris: *β*, fossil, Grignon; recent, Corsica: *γ*, fossil, Grignon." (A larger variety from near Hesse-Cassel, according to Defrance, Dict. Sc. Nat.)

Three forms of *Spiroloculina*, common in the recent and fossil state. Var. *a* is more flattened than *β*; and *γ* is still thinner, and is keeled. The last is one of the most attenuated of the *Spiroloculinæ*.

S. planulata is the oldest trivial name given to any form of this supposed genus. We have here the same shell as the *S. depressa*, D'Orb.

26. Miliolites saxorum. Ann. Mus. v. p. 352, No. 5; ix. pl. 17. f. 2; Tabl. Enc. Méth. pl. 469. f. 3 *a, b, c**. "Fossil; Mont Rouge, near Paris."

This is a *Quinqueloculina*, of a peculiar habit. D'Orbigny

* Fig. 3 *c* is the *M. opposita*, Lam. Ann. Mus. v. p. 353; but it is (probably quite correctly) here collocated with *M. saxorum*, D'Orb.

illustrates it (under the name of *Q. saxorum*) by his Modèle 33, and in the 'Ann. Sc. Nat.' vii. pl. 16. f. 10–14. Its walls are thick, elegantly marked outside with furrow-like pits, and coarsely grooved within (see d'Orbigny's fig. 13), the sarcode bearing but a small proportion to the shell-substance. The aperture is very much contracted, and its tongue is small. Sometimes the internal ridges of the chambers, coming up into the mouth of the shell, and coalescing with the lingular flap, form a sieve-like septal plane. This cribriform condition occurs only in one other subspecies of *Miliola*, namely the *Hauerina* (see the *H. compressa**, D'Orb. For. Foss. Vien. p. 119, pl. 5. f. 25–27).

Fabularia, a somewhat gigantic and nearly allied Rhizopod, built upon the plan of the *Miliolæ*, but having the internal structure of *Alveolina*, also presents this kind of aperture.

Some of the Calcaire grossier is principally made up of *Q. saxorum* and its varieties.

Q. saxorum, unadorned with pitting, is not uncommon among the coral-reefs of the warm seas of Australia and New Zealand. Other forms, with modified ornament (such as *Q. zigzag*, D'Orb. For. Foss. Vien. pl. 19. f. 16–18) are not uncommon. Defrance remarks that a recent *Miliola*, resembling *Q. saxorum*, had been received from New Holland (Dict. Sc. Nat. xxxi. p. 69).

27. Miliolites opposita. Ann. Mus. v. p. 353, No. 6; ix. pl. 17. f. 5. "Fossil; Pontoise." (Grignon and Piedmont, Defrance, Dict. Sc. nat. xxxi. p. 69.)

This is a slightly modified individual of *M. saxorum*. The figure is placed with those of the latter, and included under the same name, in the Tabl. Enc. Méth. pl. 469. f. 3.

28. Miliolites birostris. Ann. Mus. v. p. 355, No. 7. "Fossil; Chaumont." Apparently a very small, delicate, elongate variety of *M. saxorum*, such as we find extremely common in the Parisian Tertiary beds.

29. Renulina. Ann. Mus. v. p. 353; Hist. Anim. s. Vert. vii. p. 605. *Renulites opercularia*, Ann. Mus. v. p. 354; ix. pl. 17. f. 6. *R. opercularis*, Tabl. Enc. Méth. pl. 465. f. 8. "Fossil; Grignon."

This is a rare form of *Vertebralina*, under an extreme varietal condition. Resembling at first sight an *Orbiculina*, or something that might possibly be a *Peneroplis*†, the true character

* D'Orbigny has figured this as having one small oval aperture surrounded by large granules; but in reality these latter are elevations around small passages which have probably been filled up by fossilization. We have *Hauerina* from the Indian, Australian, and other tropical seas.

† It is catalogued as *Peneroplis opercularis* by D'Orbigny, Tabl. Céph. Ann. Sc. Nat. vii. p. 286, No. 6. *Renulites* and *Renulina* appear as synonyms of *Peneroplis* in Williamson's 'Monograph,' p. 44, and in other works.

of the specimen figured by Lamarck has escaped the critical investigation of the many writers on *Foraminifera*. It was only when we met with an individual (and that unique) in the rich collection of Tertiary shell-sands belonging to Sir C. Lyell that we found that this suborbicular shell, well characterized by Lamarck's figure, was an almost cyclical variety of *Vertebralina*. Accustomed as we are to the elongate, articulate, and crozier-like forms of *Vertebralina* (including *Articulina*), it is difficult, without having a wide experience of their varieties, to recognize the true relations of the form under notice. In one direction, *Vertebralina* is modified, in its weaker growths, by a disposition to exhibit simple rectilinear forms, with out-drawn equal-sized chambers, giving a rod-like shape. In this case the primordial chamber is long and tube-like,—a rare feature in *Foraminifera*. The next step is taken by the primordial chamber being subglobular, the second chamber being laid on it as a semilune, and followed by rectilinear chambers. In further gradations more and more chambers are arranged spirally (two, three, or four completing the whorl) around the first chamber, before the Articuline growth commences, whether this latter assumes the rod-like or the Vertebraline condition. Arrests of development at the spiral condition are not uncommon in any of these forms: thus we have among others the broad *Vertebralina Cassis*, D'Orb. For. Cuba, pl. 7. f. 14, 15.

The growth of a linear succession of chambers from the spiral base is the normal habit of *Vertebralina*, the anterior end of each chamber usually presenting an elegantly curved outline, with a somewhat outspread or recurved margin. In this dimorphous condition we have usually from two to five of these forth-growing chambers, which are either subcylindrical, more or less depressed, or broadly flattened, and either longer than broad, subquadrate, or transversely oblong. It is the extreme opening-out, or transverse extension, of these wider and short chambers that leads us to the lateral outgrowing and overlap of the very narrow and transversely elongate chambers in *Renulites opercularia*, which, by the successively increasing length of its symmetrical, concentric, linear chambers, with their incurved ends turned towards the spire, and overlapping the edges of the older chambers, attains this very rare subcyclical form, flat, kidney-shaped, and resembling the operculum of some minute Gasteropod.

Vertebralina is one of the *Agathistegia*, white, opake, and non-tubuliferous. It is nearly allied to *Miliola* on one hand, and to *Cornuspira* on the other. In the specimens under notice, simple as is the form of the typical shell (*V. striata*, D'Orb.), we have indications of an affinity to the cycloidal *Orbiculina* and

Orbitolites, also belonging to the family which includes the *Miliolitidæ* and their allies.

The aperture in *Vertebralina* consists merely of the simple opening at the end of the chamber, unaccompanied by any valvular flap; so that in *V. opercularia* the aperture is a slit along the peripheral margin of the last, nearly circular, chamber.

The surface in *Vertebralina* is marked by delicate striations, which, though attaining the strength of ribs in the thick-walled and more strongly characterized shells, such as *V. mucronata,* D'Orb. (For. Cuba, pl. 7. f. 16–19), become obsolete, but are very rarely absent, in the more delicate specimens. In *V. opercularia* delicate striæ are visible on the early chambers. Notwithstanding the striation, the surface in *Vertebralina* is usually beautifully smooth and opalescent. It is also occasionally pitted (as in some fossil specimens from Grignon)—a feature very constant in *Orbiculina.*

V. striata, var. *opercularia* is known only in the fossil state. Lamarck's specimen was from Grignon; our specimen is from Hauteville *. It is on the shores of Australia that we find *V. striata* making the nearest approach to *V. opercularia* amongst its living varieties.

30. Ovulites elongata. Tabl. Enc. Méth. pl. 479. f. 8; Hist. An. s. Vert. ii. p. 194, No. 2. "Fossil; Grignon."

This is an elongate-cylindrical variety of *O. Margaritula.* See above, page 291.

31. Dactylopora cylindracea. Hist. An. s. Vert. ii. p. 189. "Fossil; Grignon."

This is figured by Blainville and Defrance, Dict. Sc. Nat. Zooph. pl. 47. f. 4 (thick variety), pl. 48. f. 1 (delicate variety †). D'Orbigny has recognized it as a Foraminifer (Cours Elém. Pal. et Géol. ii. p. 192); but he has grouped it with his "Monostègues," and regarded it as a congener of *Ovulites,* for which determination there are not the least grounds, as its structure is very complicate, and to some extent allied to that of *Orbitolites.* Bronn, in the third edition of the 'Lethæa Geognost.,' places *Dactylopora* and some other forms between the *Foraminifera* and the *Bryozoa.* We may especially refer to this valuable work for the synonymy of *D. cylindracea* and *D. elongata* (*op. cit.* vol. i. pp. 256, 257), and for a list of the localities where they have been collected in France and Belgium.

a & *b.* Varieties *D. eruca* and *D. digitata.* In the East Indian and other tropical seas we have met with some curious small

* Since writing the above, we have met with several specimens nearly approaching in form to *V. opercularia* in a sample of Grignon shell-sand.

† This is termed *Polytrype elongata,* but is merely a smaller, more slender, and less worn specimen of *D. cylindracea.*

Foraminifers presenting the aspect of a little half-ring, formed of four or more thick-walled, hollow, subquadrangular segments, arranged side by side semicircularly, each chamber opening by a nipple-shaped aperture on the concave surface of the half-ring, and communicating with its neighbour by a rather large subcentral aperture in the septal face. The shell-structure resembles that of the "opake" Foraminifers. The surface of this semi-annular shell is nearly smooth and rather polished, and is sulcated at the junctions of the chambers. Rarely is the half-ring truly semicircular, the segments being often arranged on a gently curved line, and offering a resemblance to a slightly bent larva or caterpillar. Such a form as this (which we term *Dactylopora eruca*) is also found in some of the French Tertiaries; and here, besides this pupoid form, a still greater departure from the ring-shape is made sometimes by the cells becoming short cylinders perforated at both ends, partially separated one from another, and something like fragments of *Tubulipora* or *Cellipora*. This is our variety *D. digitata*.

c & *d*. Varieties *D. annulus* and *D. marginoporella*. In the Calcaire grossier of Grignon and other Tertiary deposits we find these demi-rings, and also numerous little perfect rings, having the same structure as the less perfect half-ringed shells. Of these annular forms, some present neatly packed chambers, and others divaricating subtubular chambers. A specimen of the latter has been figured and described by Michelin (Icon. Zooph. p. 177, pl. 46. f. 27) under the name of *Clypeina marginoporella*. The former variety we name *D. annulus*.

e. Var. *D. reticulata*. Besides these, there are in the Calcaire grossier of France, and in the Miocene beds of San Domingo, compound forms, made up of two or many such rings, mounted one on another symmetrically, each junction being marked by a regular series of minute round holes left by the apposition of the septal sulci of the two rings. The shell-substance between the cells is thick; but the outer wall of the chambers, being thinner, is frequently worn away, so that the specimens present large pits or openings beside the junctural interspaces. This variety is the *Larvaria reticulata* of Defrance, Dict. Sc. Nat. xxv. p. 287.

f. Var. *D. perforata*. There is a variety of *Dactylopora*, in the Grignon shell-sand, which much resembles *D. reticulata*; but the cells open outwards as well as inwards. Hence we term it *D. perforata*. The apertures, both external and internal, are large and lipped; the former are in the centre of the thin outer cell-wall, and present superficially nearly regular circles of pustulous openings. The interseptal spaces are, as a rule, hidden in this form.

g. Var. *D. glandulosa.* Vicomte d'Archiac has figured and described a fossil Microzoon (*Prattia glandulosa,* Mém. Soc. Géol. France, 1850, iii. p. 407, pl. 8. f. 20; Bronn, Leth. Geognost. 3rd edit. i. p. 28, pl. 35^3. f. 28) from the Eocene beds of Biarritz, which appears to us to be a *Dactylopora,* bearing the same relation to *D. reticulata* as *D. marginoporella* does to *D. annulus,* and *D. digitata* to *D. eruca.* We can easily suppose rings of loosely set chambers piled one on another, and, instead of forming the neat, cylindrical, cane-like form of *D. reticulata,* presenting a subcylindrical hollow body, externally roughened by numerous vesicular projections, and occasionally intersected by faint annular rings—indicative, as it were, of periodicity of growth. It is thus that we interpret the specimen alluded to; and we propose to recognize it as the variety *D. glandulosa.*

h. Var. *D. polystoma.* Another variety, from Grignon, illustrative of the transitional characters of *Dactylopora,* has three or more apertures to each cell (hence its proposed name *D. polystoma*). Besides the single internal mouth, opening into the hollow cylinder of this compound shell, there are externally at least two apertures, strongly labiate,—one opening near the base, and the other at the top of the cell. In the first or earliest ring of cells, only the upper row of openings is present. The fine specimen from which our observations were made is curved, and the convex side shows at several places the interseptal passages; where these are not visible, the rows of upper and lower apertures of contiguous cell-rings form distinct annular bands, between which the outer wall of each cell is boldly defined, and often broken through; so that three kinds of superficial perforations here tend to perplex the observer.

i. D. Bambusa (type). The stages through which *Dactylopora* passes in attaining its most compound condition are very curious, and not, at first, readily followed. We may describe them thus:—

In each of the original cells the exterior apertures become tubular, and arise from the sides, not from the outer part of the cell. Next we see the cells giving off three or more stolons (from the side and rather towards the neck), which pass through the thick shell, and open as simple round apertures on the surface, which is also characterized by annular rows of much larger passages, the latter being the junctural interspaces. This form we call *D. Bambusa.*

j. Var. *D. cylindracea.* Moreover, we find in some specimens that each of the original cells has produced from its outer surface, or fundus, a new oval or subglobular chamber, larger than itself,—the neck of the new chamber being closely adapted

to, or embracing the exterior of, the old cells. These added cavities do not appear to communicate with the surface, the shell-wall being thick. The stolon-tubes arising from the sides of the original innermost chambers pass by the sides of the great medial cæca, and terminate in small, subglobular, peripheral cells, opening by simple round apertures on the outer surface. The junctural interspaces are hidden in this highly complicate form, which is the *D. cylindracea* of Lamarck. *Polytrype elongata* of Defrance is a more attenuate variety.

These larger cylindrical forms, which are not uncommon in the Grignon deposits, present essentially the same conformation as the simpler varieties before described, with the exception, however, of the peculiar added structure, consisting of large cæcal cells and numerous smaller cells, the latter arranged quincuncially over the whole of the exterior of the cylinder, and hiding the junctural interspaces, which still remain visible in the interior. The cylinder narrows itself towards the ends, thus becoming fusiform.

The surface of the external or superadded series of chambers, when perfect, is smooth, and marked by the regularly-arranged round apertures; but when worn (as is very frequently the case), the outer cell-walls disappear, leaving smooth cup-shaped hollows, each perforated at the bottom with the canal of the connecting stolon. The quincunx gives visually a hexagonal or honeycombed appearance to the worn surface. When the passages between the first chambers and the exterior exist as tubes only (as in *D. Bambusa*), the worn surface has a pitted aspect; and in other varieties several different complications of large and small apertures are seen in worn specimens. In the figure of a very large specimen of *D. cylindracea*, from Grignon, given by Goldfuss (pl. 12. f. 4), we see carefully drawn a quincuncial lattice of the worn cells, with small interspersed openings of supernumerary pseudopodial passages from primary cells. This character is not given in Defrance's figures, nor have we yet met with it in our own specimens.

Lamouroux figures and describes a large specimen under the name of *Reteporites digitalia* (Polyp. p. 44, pl. 72. f. 6–8).

Michelin's *Uteria Encrinella* (Icon. Zooph. p. 177, pl. 46. f. 26), from the Eocene beds of Cuisse-Lamotte (Oise) is a specimen of *D. cylindracea*, presenting an unusual shortness of cylinder, evidently perfect and unworn.

Michelin's *Turbinia graciosa* (Icon. Zooph. p. 177, pl. 46. f. 15), from Grignon and Cuisse-Lamotte, appears to be a short *D. cylindracea*, which, after having developed a few normal circles of compound cells, was finished off with a converging series of less complex cells.

In some unequally grown *Dactyloporæ* we can trace the coexistence of the more compound with the simpler form of structure. Thus in some tapering specimens we can discern in the thicker part that the large cæcal cells have been developed, which are characteristic of *D. cylindracea*, whilst the cæca gradually diminish and disappear in the constricted portion, which approaches in its structure to that of *D. Bambusa.*

All these peculiar organisms, recent and fossil, are related within specific limits, the passage from the simple to the compound being step by step, and not unlike similar transitions and gradual complications seen in *Orbitolites* and others of the "opake" *Foraminifera.* According to our plan of choosing for the type of a species the form furthest removed from extremes, and yet indicating the main essentials of the structural features of the whole specific group, we select *D. Bambusa* for the typical form.

The structural details of *Dactylopora* deserve full attention: the brief descriptions given above are but indications of its peculiar construction.

Besides the French and Belgian Eocene Tertiaries, the Miocene beds of San Domingo yield *Dactylopora.*

[To be continued.]

LI.—*Mollusca Japonica: New Species of* Chrysallida *and* Parthenia. By Arthur Adams, F.L.S., &c.

The Sea of Japan appears to be as well stocked with the smaller species of *Pyramidellidæ* as the seas of Europe. The reason why Clark speaks of this family as a "truly British group, which far outnumbers the discoveries of any other country," is that these little Mollusks live in comparatively deep water, and no naturalist has hitherto brought them to light. By some hard work and perseverance I have discovered many new Mollusca in different parts of the world, and I shall now describe eight species of *Chrysallida* and three of *Parthenia* from Japanese waters. In another communication I shall give descriptions of some new species of the allied genera, such as *Turbonilla, Odostomia, Dunkeria, Aclis,* and *Ebala.* Some of these forms may be found also in the China Sea, as I frequently meet with examples of species which are common to the south and the north of the Korea Strait.

N.B. In a former paper I gave the name *Huxleyia* to a new genus of bivalve Mollusca. Should, however, this name have

been already used, which is not improbable, *Cyrilla* might be substituted for it.

1. *Chrysallida plicata*, A. Adams.

C. testa ovato-oblonga, anguste rimata, alba, longitudinaliter plicata; anfractibus normalibus 5, convexiusculis, plicis obliquis æqualibus ad suturas productis et tuberculatis, interstitiis simplicibus, anfractu ultimo linea spirali elevata ad peripheriam circumcincto, suturis acute exaratis; apertura ovali, labro postice vix angulato; plica parietali transversa.

Hab. Mino-Sima; 63 fathoms.

2. *Chrysallida semiplicata*, A. Adams.

C. testa ovato-oblonga, alba, rimata, longitudinaliter semiplicata; anfractibus normalibus 4, planiusculis, ad suturas angulatis; plicis obliquis, æqualibus, in anfractu ultimo ad peripheriam subito obsoletis; basi lævi rotundata; apertura oblonga, antice producta; plica parietali subcelata.

Hab. Mino-Sima; 63 fathoms.

3. *Chrysallida Minna*, A. Adams.

C. testa ovato-oblonga, anguste rimata, alba, longitudinaliter costata; anfractibus normalibus 5, planatis, ad suturas angulatis; costis validis, rectis, in anfractu ultimo antice subobsoletis; interstitiis simplicibus; apertura oblonga, subquadrata; plica parietali obliqua, valida; labro rectiusculo, postice subangulato.

Hab. Mino-Sima; 63 fathoms.

4. *Chrysallida Brenda*, A. Adams.

C. testa ovato-oblonga, anguste rimata, alba, longitudinaliter costata; anfractibus normalibus 3, planulatis; suturis profundis; costis validis, rectis, ad suturas productis, acutis; apertura oblonga; plica parietali obliqua, subspirali; labro postice vix angulato.

Hab. Mino-Sima; 63 fathoms.

5. *Chrysallida metula*, A. Adams.

C. testa gracili, tereti, pupiformi, alba, rimata, nitida, longitudinaliter plicata; anfractibus normalibus 6, planatis; suturis impressis; plicis validis, confertis, obliquis; apertura parva, rotundato-ovata; plica parietali transversa, valida.

Hab. Mino-Sima; 63 fathoms.

6. *Chrysallida elegantula*, A. Adams.

C. testa ovato-turrita, imperforata, albida, longitudinaliter costata; anfractibus normalibus 4, planatis, ad suturas angulatis; costis

rectis, validis, distantibus; interstitiis simplicibus; labro postice subangulato; plica parietali obliqua.

Hab. Mino-Sima; 63 fathoms.

7. *Chrysallida pulchella*, A. Adams.

C. testa ovato-oblonga, turrita, anguste rimata, albida, longitudinaliter costata; anfractibus normalibus 4, planatis, postice angulatis et crenulatis; costis obliquis, æqualibus, antice obsoletis; interstitiis transversim striatis; apertura rotundato-ovali; labro postice vix angulato; plica parietali parva, obliqua.

Hab. Mino-Sima; 63 fathoms.

8. *Chrysallida concinna*, A. Adams.

C. testa ovato-turrita, alba, rimata, apice obtusa, longitudinaliter costata; anfractibus normalibus 4, planatis, postice angulatis; suturis valde exaratis; costis rectis, postice productis et acutis; interstitiis transversim tenuiter striatis; apertura oblonga, antice producta; labro postice angulato.

Hab. Mino-Sima; 63 fathoms.

1. *Parthenia diadema*, A. Adams.

P. testa ovato-conica, anguste rimata, alba, cancellata; anfractibus normalibus 3, planulatis, postice angulatis et concinne crenatis quasi coronatis; costis subdistantibus, antice subobsoletis; liris transversis validis, crenatis; apertura ovata, antice subreflexa; labro postice angulato.

Hab. Mino-Sima; 63 fathoms.

2. *Parthenia monocycla*, A. Adams.

P. testa ovato-conica, anguste rimata, alba, longitudinaliter costata; anfractibus normalibus 4, ad suturas angulatis et crenulatis; costis rectiusculis, ad suturas productis, acutis; anfractu ultimo magno, lira moniliformi in peripheria circumcincto; interstitiis obsolete clathratis; apertura ovata, antice subproducta et angulata; labro postice angulato.

Hab. Mino-Sima; 63 fathoms.

3. *Parthenia foveolata*, A. Adams.

P. testa ovato-conica, imperforata, alba, longitudinaliter costata; anfractibus normalibus 3; costis obliquis, antice obsoletis; interstitiis foveolatis; anfractu ultimo cingulis spiralibus ornato; suturis exaratis; apertura ovali, antice rotundata; plica parietali parva.

Hab. Mino-Sima; 63 fathoms.

Shanghai, Jan. 6, 1860.

LII.—*On the* Lucernaria cyathiformis *of Sars.* By P. H. Gosse, Esq., F.R.S., A.L.S.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,

In the 'Quarterly Journal of Microscopical Science' for this month, Professor Allman has described and figured what he considers to be the *Lucernaria cyathiformis* of Sars, instituting for it a new genus, under the name of *Carduella*. I feel sure he was not aware that I had already separated it from *Lucernaria*, under the generic name of *Depastrum*, in the 'Annals' for June 1858, page 419 *.

But I also had found what I supposed to be the *L. cyathiformis* on repeated occasions at Weymouth, viz. in the spring and summer of 1853. The specimens were in each case affixed to the under surfaces of stones at very low water. I had made careful magnified figures of my specimens, which I forward with this letter. It is manifest that Prof. Allman's and mine do not represent the same species; and, on comparing each with Sars's diagnosis (as cited by Johnston, Br. Zooph. i. 474, the only reference at my command), it appears that the Orkney species agrees with the Norwegian, while the Weymouth species differs from it.

The most important points of difference are: 1. the disk in *Depastrum cyathiforme* is circular and entire, in *D. stellifrons* (by which name I propose to distinguish the southern type) distinctly 8-angled; 2. the tentacles in *D. cyathiforme* are unifarious and equal, in *D. stellifrons* bi- or tri-farious and notably unequal; 3. the tentacles in *D. cyathiforme* spring from a circle within the margin, in *D. stellifrons* from the margin or without it; 4. in *D. cyathiforme* the tentacles are represented as very regularly capitate; in *D. stellifrons* the distinction between the pedicle and the head is much less marked, and they are frequently rather clavate than capitate; 5. the hue in *D. cyathiforme* is represented as brownish-red; in *D. stellifrons* it was (in my specimens) a dull olive, becoming pale on the disk, and tinged with umber on the body, the tentacles and ovaries white. The disk in *D. stellifrons* was studded with minute white granules, arranged in eight radiating groups.

It follows that a new generic diagnosis is needed for this form; for both the one I had given for *Depastrum* and the one Prof.

* In the 3rd vol. of the 'Histoire Naturelle des Coralliaires,' just published (1860), M. Milne-Edwards has given a third generic title to the same animal, viz. that of *Calicinaria*.

Allman has now given for *Carduella* are defective, each containing characters that belong to the particular species respectively. The diagnoses of both genus and species may be corrected thus:—

DEPASTRUM, Gosse.

Corpus repente contractum, et supra et infra alvum.

D. cyathiforme, Sars.

Discus circularis; tentacula monosticha, æqualia, intra marginem disci salientia.

D. stellifrons, Gosse.

Discus octangularis; tentacula di- tristicha, inæqualia, ad marginem disci salientia, inter angulos.

I am, Gentlemen,
Your obedient Servant,
P. H. GOSSE.

Torquay, April 7, 1860.

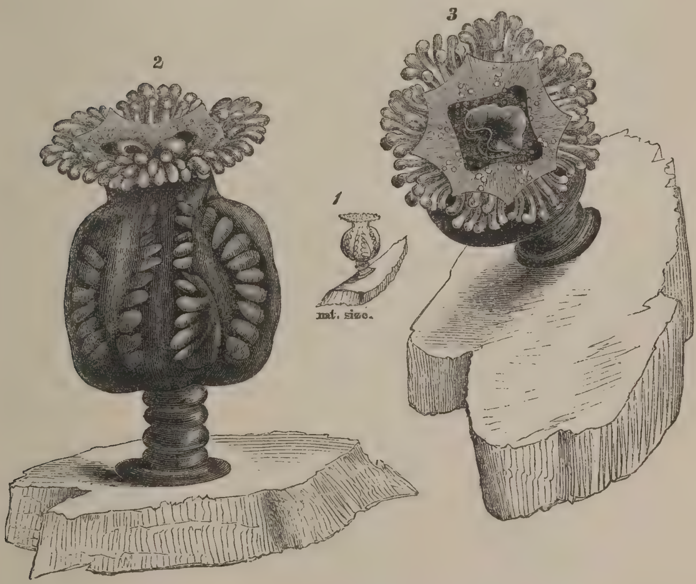

Fig. 1. *Depastrum stellifrons,* natural size.
Fig. 2. The same, magnified, lateral aspect.
Fig. 3. The same, magnified, vertical aspect.

LIII.—*On the Tribe* Colletieæ, *with some Observations on the Structure of the Seed in the Family of the* Rhamnaceæ. By John Miers, F.R.S., F.L.S. &c.

[Continued from p. 381.]

Division 3. **Clithrocarpæ.** Flores petaliferi; fructus nucamentaceus et lignosus aut membranaceus, fere semper indehiscens.

6. Retamilia.

This genus is very distinct from all others of this tribe, differing in its peculiar virgate habit, its almost aphyllous Ephedra-like erect branches; the reduction of its disk to the size of a mere torus, or stipitate support of the ovary; and its large, spherical, thick, nuciform fruit. The name of *Retanilla* was first applied (in 1825) by DeCandolle, in his Prodromus (ii. 28), to a section of the genus *Colletia*, under which he arranged two plants, distinguished from others of that genus by the presence of petals and the absence of the conspicuous disk: these were the *Rhamnus Retamilla* and *Rhamnus Ephedra* of Dombey, both collected by him in Chile,—Ventenat having previously described both plants as species of *Colletia*. Brongniart (in 1827) adopted the suggestion of DeCandolle, in his Monograph of the *Rhamnaceæ*, and established the genus *Retanilla* for the same plants, making the type of his genus the *Colletia obcordata*, Vent. (identical with *Rhamnus Retamilla*, Domb.).

There has been an error, originating with DeCandolle (Prodr. ii. 28), in converting Dombey's Spanish name, *Retamilla*, into *Retanilla*, the former being the diminutive of *Retama*, or common Broom of Europe, which resembles the Chilean plant in its almost leafless virgate stems; but, as the Spanish *ll* has invariably a liquid pronunciation, it is desirable to correct the spelling in harmony with it, and thus *Retamilia* becomes the more appropriate name. One of the peculiarities of the genus consists in the structure of its fruit, which is much larger than in any other genus of the tribe, is somewhat drupaceous, with a fleshy epicarp that becomes coriaceous, and incloses a hard, ligneous, indehiscent nut, the partitions between its cells being very thick and woody; it is smooth, with three slight furrows, corresponding with the lines of the dissepiments; the transverse disposition of the woody fibres of the thick endocarp appears a constant character, worthy of notice. As previously mentioned, Brongniart quotes this as one of the few genera of the *Rhamnaceæ* in which stipules are wanting; but in all the specimens I have seen they are certainly developed in the manner peculiar to most of the *Colletieæ*. The generic character is emended in the following manner:—

RETAMILIA, Brongn. *Molinæa*, Comm.—*Calyx* tubuloso-campanulatus, carnosulus, limbo 4–5-fido, laciniis triangularibus, erectis, intus carina calloque apicali notatis, æstivatione valvatis, tubo infra medium intus piloso, pilis patentibus, demum caducus. *Petala* 4–5, erecta, laciniis alterna et æquilonga, in os tubi cum staminibus inserta, obovata, unguiculata, concava, cucullata. *Stamina* 4–5, petalis opposita et iis recondita; *filamenta* subulata, glabra, apice inflexa; *antheræ* rotundatæ, reniformes, 2-valves (valva antica breviore), circa connectivum carnosum reniforme semi-annulares, rima hippocrepica hiantes, demum peltatim expansæ, et tunc disciformes, medio umbonatæ. *Discus* fere obsoletus, vix ultra ovarii basin extensus. *Ovarium* conico-oblongum, 3-loculare; *ovula* in loculis solitaria, erecta. *Stylus* erectus, calyce dimidio brevior. *Stigma* fere obsoletum, obtuse 3-punctatum. *Fructus* globosus, pro mole majusculus, baccatus; sarcocarpium spongioso-carnosum, demum siccum et crasso-coriaceum: nux sphærica, 3-sulcata, dura, lignea, crassa, indehiscens, 3-locularis, loculis monospermis. *Semen* erectum, ovatum, subcompressum, structura omnino illius *Colletiæ*.

Suffrutices *Chilenses dumosi*, ramis ramulisque *longissime virgatis, teretibus, erectis, fere aphyllis, inermibus*, nodis *distantibus*; stipulæ *oppositæ, parvulæ, squamiformes, gibbosæ, acutæ, fuscæ, linea transversali prominula utrinque connexæ*; folia *opposita, minuta, caducissima, spathulato-oblonga*; flores *albi, oppositi, hinc distantiores et utrinque solitarii in ramulis novellis enati, vel in gemmam squamosam axillarem capitato-agglomerati.*

1. *Retamilia obcordata*, Brongn. Ann. Sc. Nat. x. 364. tab. 14;—Colletia obcordata, *Vent. Hort. Cels.* tab. 92; *Poiret in Lam. Dict. Suppl.* ii. 311;—Colletia (Retanilla) obcordata, *DC. Prodr.* ii. 28;—Rhamnus Retamilla, *Domb. MSS.*;—suffruticosa, 3-pedalis, ramis ramulisque erectis, virgatis, flexibilibus, apice mucrone apiculatis, junioribus albo-tomentosis, demum glabris, nodis remotis, quasi articulatis propter stipulas 2 oppositas majusculas acutas adpressas demum patentes inter se nexas; ramulis rarius abortivis, brevibus, et tunc spiniformibus; foliis oppositis, raris, cito caducis, inferioribus obcordatis, in petiolum brevem cuneatis, superioribus spathulato-ovatis, pubescentibus, 3-nerviis, pallide viridibus; floribus plurimis, fere sessilibus, glomerato-fasciculatis, vel sæpe interrupte spicatis; calyce urceolato, fulvo, extus villosulo, intus imo puberulo, limbi laciniis 5, acutis, erectis; petalis 5, cucullatis, unguiculatis, laciniis fere æquilongis; staminibus reconditis, antheris apertis peltiformibus; ovario pubescente.—Chile.

—*v. s. in herb. Mus. Paris* (Ventenat) ex specimine culto cum notula "Pérou" (sine dubio erronea).

I am not aware of the existence of any indigenous specimen; nor is the exact place of its growth known. The species was established by Ventenat, who made his drawing above quoted from a plant raised from seeds brought home by Dombey, first cultivated by M. Cels, and afterwards in the Jardin des Plantes, where Poiret also saw it growing. The specimen now in the Paris herbarium, which I have seen, was contributed by Ventenat: his drawing well accords with it. It is described as a shrub having much the appearance of a *Spartium*, growing to the height of 3 feet. In the structure of its flower it quite agrees with that of the two following species, the characters of which are better known; the only negative feature attached to it is the account recorded by Ventenat of its fruit, which is said to be 3-coccous, and therefore at variance with the structure known to exist in the other species and in *Trevoa*; but as it is very improbable that the fruit ever ripened in Paris, and as in the immature state it was found to be trilocular, we may conclude that it was only assumed to be 3-coccous, like the other known species of *Colletia*, to which genus it was thought to belong. Ventenat, on the other hand, mentions its fleshy mesocarp, which becomes coriaceous in drying, as I have found it in *R. stricta*.

2. *Retamilia Ephedra*, Brongn. Ann. Sc. Nat. x. 365; Hook. Bot. Misc. i. 157; ibid. iii. 173; — Colletia Ephedra, *Vent.* (*non Bert.*) *Choix*, tab. 16; *Lodd. Bot. Cab.* pl. 1820;— Rhamnus Ephedra, *Domb. MSS.*; — suffruticosa, dumosa, ramulis imo spinosis, superne inermibus, valde strictis, virgatis, compresso-teretibus, forte striatis, cortice carnoso vestitis, junioribus albido-tomentosis, demum glabris; nodis distantibus, stipuliferis, stipulis oppositis, gibbo-squamiformibus, fuscis, acutis, utrinque linea transversali nexis; foliis nullis, aut caducissimis; floribus plurimis, in capitulum subglobosum sessile utrinque axillare aggregatis, aut paucioribus, in spicam brevissimam enatis; pedunculo brevissimo, calyce urceolato, roseo-albido, extus pubescente, tubo intus imo piloso, pilis longis patentibus, limbi laciniis 4, brevibus, erectis, petalis 4, niveis, oblongis, unguiculatis, cucullatis, erectis, staminibus totidem, vix æquilongis, ovario conico-oblongo, piloso, stylo brevi, crassiusculo, ad medium attingente; fructu globoso.—Chile.—*v. s. in herb. meo*; Chile (Ruiz & Pavon), sine loco designato;—*in herb. Mus. Paris* (specim. typicum, Dombey); "Pérou," potius Chile;—*in herb. Hook.*; in convallibus Andium Chilensium; Concepcion (Lay & Collie); Chile, sine loco (Cuming, 704).

This is a well-established species; its Ephedra-like branches

are rather stout, equal in thickness throughout, of considerable length, and about a line in diameter, the nodes being about 1–1½ inch apart; occasionally a few spines (or stunted branchlets) are seen, which are nearly erect, deeply striated, with a callous, pungent apex, and are 1–1¼ inch long. A capitate inflorescence is seen in the opposite axils of each node of the virgate branches; it is about ½ inch in diameter, and consists of an aggregation of small flowers; the peduncles are extremely short; the calycine tube is 1 line long, its segments being ⅓ line in length, it is 1¼ line in diameter*.

3. *Retamilia stricta*, Hook. Arn. Bot. Misc. iii. 173;—Retanilla affinis, *Clos, in Gay, Chile*, ii. 26;—suffruticosa, sesquiorgyalis, ramosa, ramis e basi plurimis, assurgentibus, ramulis strictis, virgatis, rigidis, erectis, glabris, teretibus, striatulis, fere aphyllis, nodis remotis; foliis oppositis, parvulis, rarissimis, caducissimis, spathulato-oblongis, carnosis, pilosiusculis, lateribus canaliculatim reflexis, breviter petiolatis; stipulis axillaribus, gibboso-squamiformibus, fuscis, acutis, oppositis, et utrinque linea transversali nexis; ramulo florifero brevi, aphyllo, racemiformi, nodis crebris, floriferis, squamis oppositis munitis; floribus ibi oppositis, solitariis, et hinc quasi racemoso-spicatis; calyce late cylindrico, carnoso, roseo-albido, extus glabro, intus imo piloso, pilis patentibus, limbi laciniis 5, triangularibus, erectis, demum e basi caduco; petalis 5, laciniis æquilongis, ovatis, cucullatis, unguiculatis, erectis, niveis; staminibus totidem, petalis reconditis, demum inflexis; ovario oblongo, 3–4-sulcato, stylo incrassato, subulato, tereti, longitudine fere tubi, pilosissimo, pilis longis, albis, creberrimis, patentibus; stigmate 3–4-lobo, lobis obtusis, adpressis; fructu globoso, cortice coriaceo, crasso, disco substipitiformi suffulto; nuce conformi, durissimo, indehiscente, lignoso, 3-, rarius 4-loculari, seminibus nitentibus. — Chile. — *v. v.* ad Quintero (*Retama* et *Retamilla* incolarum).—*v. s. in herb. Hook.*; Valparaiso (Cuming, 402);—*in herb. Mus. Paris*; in Prov. Cauquenes (Gay), vernac. *Frutilla del Campo.*

This species, as far as my observation extends, does not grow in the immediate neighbourhood of Valparaiso, but at a distance of twenty or thirty miles from that port, near the coast, where the violent surf and the strong incessant trade-wind produce elevated flats of considerable extent, formed of loose drift-sand carried to some distance in-shore; and it was only in such situations that I met with this shrub, growing among other trees and bushes. It is distinguished by well-marked characters from the preceding species. It grows to a height of 8 or 10 feet, with a

* This species will be shown in the 'Contributions,' Plate 39 D.

broom-like habit, having very long, straight, erect branches, more woody than in the preceding species, and all terminating in an acute spine. The stemlets are more slender, less deeply striated, with the internodes about $\frac{3}{4}$ inch apart; out of these nodes, in the younger branches, short foliiferous sprouts make their appearance, and out of the nodes of the upper part of the principal (annotinous?) branches, are produced the opposite spicated racemes of flowers, which are nearly the length of the internodes, bearing about three or four pairs of opposite flowers. The leaves are 1–1$\frac{1}{2}$ line long, only $\frac{1}{2}$ line broad, cuneate, upon a very short petiole, entire, fleshy, 3-nerved, slightly pubescent, and folded back upon themselves; the pedicels are $\frac{1}{2}$ line long, bracteated at base; the tube of the calyx, including the segments, is 1$\frac{1}{2}$ line long, and 1 line in diameter; the flowers are of a rose-colour. The fruit is spherical, 8 lines in diam.*

4. *Retamilia articulata*, n. sp.;—Colletia articulata, *Philippi, Linn.* xxviii. 679;—suffruticosa, glaberrima, ramis teretibus, lævibus, simpliciter intricatim spinosis, spinis longiusculis, ramulisque articulatim nodosis, creberrime granuloso-punctulatis, apice calloso-pungentibus; foliis in ramulis novellis parvulis, ovatis, utrinque acutis, integris, crassiusculis, eveniis, glaberrimis, caducissimis, petiolo canaliculato in sinum stipulæ 2-dentatæ affixo; stipulis oppositis, linea transversali nexis (nodis proinde quasi articulatis); floribus in articulationibus utrinque 2–4, fasciculatis, e tuberculo bracteato enatis, pedunculo flori æquilongo, calyce cylindrico, limbi laciniis 4, triangularibus, erectis; petalis 4, squamiformibus, acutis, laciniis dimidio brevioribus; staminibus totidem, filamentis incurvatis, brevissimis, antheris ovalibus, petalis 2-plo latioribus, rima hippocrepica hiantibus, peltatim affixis; stylo brevi, incluso; stigmate capitato-3-lobo.—In Andibus Chilensibus versus Chillan (lat. 36° S.).—*v. s. in herb. meo et Hook.* (Germain).

This plant has much the habit of the three preceding species, but its branches are not so virgate, and have much shorter internodes: the branches, almost bare of leaves and spines, are quite terete, perfectly smooth, the internodes being $\frac{1}{2}$ to $\frac{3}{4}$ inch apart; the spines are 8 to 12 lines long, the floriferous branchlets are twice or three times that length, having the appearance of articulated spines, and are often again spinose. The stipules at the nodes are small, simple, and acute, and the line of their connexion gives an articulated appearance to the branches. Very young branchlets, bearing leaves and flowers, grow out of the upper nodes, and, from the proximity of the axils, they appear

* A representation of this species, with analytical details, will be given in the 'Contributions,' Plate 39 E.

almost agglomerated: the leaves are very small, ovate, or oblong, fleshy, nerveless, and obsoletely toothed on their margin, tapering into a short petiole; they are $1\frac{1}{2}$ line long, 1 line broad, in opposite pairs upon a slender nascent shoot about $\frac{3}{4}$ inch long. From the axils and the articulations of the spines a short sprout is seen, bearing a few leaves and two or four flowers, which are almost fasciculated; the pedicels are a full line long; the cylindrical tube of the calyx is $1\frac{1}{2}$ line long, with four segments of a quarter their length; the petals are like small white scales, intermediate with the segments, and only a quarter of their length; the anthers are like those of the preceding species; the ovary and style are glabrous. The flowers are pale when dried, and are probably nearly of a white colour when fresh*.

7. Trevoa.

This genus, first proposed by me (in 1825), was afterwards described by Sir William Hooker (in 1830), in the 'Botanical Miscellany,' where it is confounded with *Talguenea*; he subsequently (in 1833) suppressed the genus, referring the plant on which it was founded to *Retamilia*, because of its indehiscent fruit. In *Trevoa*, however, we have a tree of very hard wood, spreading into numerous thick tortuous branches, and equally tortuous branchlets, which are very spiny, with an abundant foliage, offering a strong contrast to the bare Ephedra-like branches of *Retamilia*. In *Trevoa* the calyx is persistent, does not enlarge, but remains withered, entire, and membranaceous, at the base of its fleshy drupe; while in *Retamilia* the whole of the calyx falls away, leaving its short stipitate torus (or small adnate disk) to support a much larger globular fruit. The form of the calyx is also dissimilar in the two genera, and the petals are larger and more cucullate. In the species on which I founded the genus, the ovary is uniformly bilocular, producing a small 2-celled fruit, often by abortion 1-locular: another species, which Sir William Hooker had inferred to be identical with mine, has a 3-celled ovary, producing a larger 3-celled nut, which circumstance induced that distinguished botanist to merge the genus into *Retamilia*; but the characters above mentioned are sufficient to keep them distinct. There is, however, another distinguishing feature in the shape of the stipules, which in *Trevoa* are deeply bifid, forming a small fuscous linear kind of wing attached to each side of the petiole, of nearly equal length, by which they are attached to the stem; and the bases of the opposite petioles are connected on each side by a transverse line across the stem.

By other botanists *Trevoa* has been confounded with *Talguenea*; but the differences here are yet more strongly marked: the latter

* This plant will be shown in the 'Contributions,' Plate 39 F.

has not only a distinct form of calyx, but it is quite dissimilar in the structure of its fruit, which is enclosed in the entire unchanged persistent calyx, and which consists of an evalvate indehiscent membranaceous pericarp that bursts by laceration, only to allow of the escape of the seeds. The name of the genus was derived from the vernacular appellation of the typical species, *Trévo* or *Trébu*. Its character is thus defined:—

Trévoa, nob.—*Calyx* petaloideus, tubulosus, tubo imo inflato, medio sæpe constricto, fauce paulo ampliore, intus præsertim versus basin villosissimo, pilis albidis retrorsis, limbi laciniis 4 vel 5, triangularibus, erectiusculis, intus carina calloque notatis, marcescens et persistens. *Petala* 4–5, rotundata, cucullata, unguiculata, laciniis calycinis breviora, erecta. *Stamina* 4–5, petalis inclusa, et cum eorum unguibus inter lacinias inserta; *filamenta* brevia, pilosa, imo complanata, subulata, apice repente inflexa; *antheræ* rotundatæ, eis *Retamiliæ* similes. *Discus* parvus, carnosus, ovario 3-plo latior, subconcavus, adnatus. *Ovarium* e medio disci superum, conico-oblongum, 2–3-sulcatum, hirsutissimum, 2–3-loculare. *Stylus* erectus, 3–4-gonus, angulis ciliatis, imo validiusculus et hirsutissimus. *Stigma* 2–3-lobum, lobis obtusis arcte adpressis, albidum. *Fructus* drupaceus, ovatus, subcompressus, calyce marcido imo suffultus, endocarpio indehiscente nucamentaceo, 2–3-loculare, vel abortu uniloculare. *Semen* in quoque loculo solitarium, erectum, compresso-ovatum, nitidissimum, structura omnino *Colletiæ*.

Arbusculæ *Chilenses frondosæ, ramosissimæ, spinosæ, trunci ligno duro*, ramis *oppositis*, ramulis *infra spinas foliiferis et floriferis*, spinis *oppositis*; folia *opposita, ovata, serrulata*, 3-*nervia, fere glabra*; flores *e ramulis junioribus enati, in axillis oppositis solitarii, vel* 2–3, *fasciculati, hinc foliis carentibus sæpe racemosi, aut axillis approximatis quasi spicati*.

1. *Trevoa trinervis*, nob. Trav. ii. 529;—T. trinervia, *Hook. Bot. Misc.* i. 159;—Retanilla trinervia, *Hook. in parte, ibid.* iii. 174;—Colletia Trebu, *Bert.*; *Colla, Mem. Torin.* 37. p. 53;—arbuscula sesquiorgyalis, ligno duro rubente, ramosa, ramulis compressis, foliosis, spinosis, junioribus inermibus foliiferis et floriferis sub spinis enatis; spinis viridibus, decussatim oppositis, compresso-subulatis, calloso-pungentibus, patentissimis; foliis oppositis, ovalibus, mucronulatis, imo in petiolum cuneatis, crenulato-dentatis, 3-nervibus, nervis pellucidis subparallelis, lateralibus versus marginem ramosis, et hinc in glandulas marginales excurrentibus, reticulato-venosis, glabriusculis, petiolo brevi, canaliculato, singulis e stipula fusca bifida ortis; floribus interdum quasi spicatis; pedunculo brevissimo, piloso;

calyce extus superne subgloboso, albescente, imo inflato, viridi et piloso, limbi laciniis 4, erectiusculis; petalis 4, niveis, laciniis brevioribus; staminibus 4, inclusis; antheris reniformibus, flavis, connectivo albo; stylo ovarioque 2-loculari pilosissimis; fructu ovali, subcarnoso, calyce marcido fulto; nuce ovata, 2-loculari, sæpe abortu 1-loculari.—Chile.—*v. v.* ad Concon.—*v. s. in herb. Hook.* (Cuming, 732).

This tree is of frequent occurrence upon the hills throughout the province of Quillota, in which the port of Valparaiso is situated, and is, I believe, more generally distributed, at no great distance from the sea-coast, in the central provinces of Chile: sometimes it appears as a tall bush, but it grows ordinarily to the height of 8 or 10 feet, with widely-spreading branches. Its trunk, scarcely exceeding 4 or 6 inches in diameter, consists of hard red wood, which is much sought for, as it makes an excellent fuel; it is also greatly in request for building purposes. Its spreading, opposite, subulate, green spines, which decussate at the distance of half an inch apart, are from half an inch to 1 inch in length. A single leaf issues from its corresponding stipule, that springs from the base of each spine. The leaves ordinarily measure $\frac{3}{4}$ inch, sometimes an inch in length, and 3 or 4 lines in breadth, the petiole being 1 line long. Each floriferous branch usually originates from the expansion of a tubercle situated between the spine and the stipule, and is commonly from $1\frac{1}{2}$ to 3 inches long, with several decussating pairs of leaves towards its base, at distinct intervals of 1 to 3 lines, at each of which points two or four flowers arise, the leaves gradually disappearing towards the ends of these branchlets, the axils then approximating by degrees, so that the flowers assume a spicate appearance; each flower is from $1\frac{1}{2}$ to 2 lines long, on a peduncle less than a quarter of a line in length; the calyx is of a yellowish-white colour, is somewhat contracted in the middle, glabrous in the upper part, the inflated base and peduncle being of a greenish hue and pubescent; it is constantly 4-toothed on its border, all its parts being 4-merous, and the hooded petals snow-white. Its somewhat compressed oval drupe, enclosing a hard nut, is 2 lines long, and $1\frac{1}{2}$ line in diameter; the nut is ligneous and indehiscent*. Cuming's specimen in Sir William Hooker's herbarium is not in seed. Germain's plant, distributed under the name of *Trevoa 3-nervia*, is *Notophæna foliosa*.

2. *Trevoa tenuis*, n. sp.;—Retanilla 3-nervia, *Hook. & Arn. in parte, Bot. Misc.* iii. 174;—arbuscula præcedentis simillima, sed omnino pilosior, spinosa, ramulis sub-4-gonis, tenuibus,

* This plant, with analytical details, will be shown in the 'Contributions,' Plate 40 A.

compressiusculis, pallide viridibus, glaberrimis, junioribus sæpe spinosis, spinis longiusculis, decussatim oppositis, simplicibus; foliis oppositis, ovalibus, imo in petiolum brevem attenuatis, integris, aut crenulato-dentatis, 3-nervibus, margine glanduliferis, glabris, junioribus utrinque pilosulis, et pulvere resinoso flavicantibus; floribus binis in axillis oppositis, et in ramulis novellis, foliorum defectu, sæpe glomerato-spicatis; calyce colorato, late cylindrico, haud constricto, extus valde pubescente, intus imo piloso; limbi laciniis 5, brevibus, erectiusculis, cum petalis 5, æquilongis, niveis, cucullatis, alternis; staminibus totidem, petalis inclusis, et iis dimidio brevioribus; filamentis brevibus, in lineis totidem patenti-pilosis decurrentibus; stylo brevi ovarioque 3-loculari longe patenti-pilosis, stigmatibus 3, oblongis, obtusis, adpressis, glabris; drupa carnosula, præcedentis 4-plo majore, ovata, nuce dura, crassiter lignosa, 3-loculari.—Chile.—*v. s. in herb. Hook.*; Bustamante, in via ad Santiago, alt. 2000 ped. (Bridges, 435; Cuming, 641).

This species is unquestionably distinct from the preceding, though much resembling it in general aspect; it is, however, much more spiny, its branchlets are thinner and straighter, its spines longer and more slender, its leaves smaller and more caducous. The internodes are $1\frac{1}{4}$ inch apart, the spines $1\frac{1}{4}$–$1\frac{1}{2}$ inch long; those of the lateral spinose branchlets are about $\frac{3}{4}$ inch long; the floriferous branchlets are $1\frac{1}{2}$ inch long, the axils being from 1 to 3 lines apart. The leaves are 3–5 lines long, and 2 lines broad, upon a petiole 1 line in length; its flowers are constantly 5-merous; its calyx, 2 lines long, is double the diameter of that of the former species, and is scarcely contracted in the middle; externally it is very pubescent, its ovary is always 3-locular (not 2-celled), and it produces a much larger fruit, which is two or three times the size of that of *T. trinervis*, being 4 or 5 lines long, and 3 or 4 lines in diameter: the ligneous walls of its 3-locular nut are thicker than in the foregoing species. In other respects both kinds are much alike. It appears to grow further away from the coast, upon the more elevated table-lands, and in the valleys of the interior*.

3. *Trevoa Berteroana.*—Retanilla spinifer, *Clos, in Gay, Chile*, ii. 27;—spinosa, ramulis rectis, tenuibus, striatulis, glabris, fusco-viridibus, ortis sub spinis; spinis oppositis, tenuibus, subulatis, calloso-acicularibus, paulo patentibus; foliis oppositis, vel sæpe in axillis utrinque binis, cuneato-ovatis, vel obcordatis, apice obtusis, retusis et mucronulatis, integris vel

* This species will be represented in the 'Contributions,' Plate 40 B.

obsolete dentatis, 3-nerviis, utrinque sparsim puberulis, supra viridibus, subtus albido-pulverulentis, nervis rubescentibus, pellucidis; petiolo brevi canaliculato; stipulis distinctis, oppositis, patentibus, rubellis, obsolete 2-dentatis; floribus parvis, in axillis ramulorum 1 vel 2, pedunculo brevi, puberulo; calyce breviter tubuloso, extus imo puberulo, superne glabro, intus valde piloso, limbi laciniis 4, brevissimis, subpatentibus, petalis 4, laciniis æquilongis, orbicularibus, cucullatis, antheris iis inclusis; drupa sicca ovali, mole fructus *T. trinervis*, apice retrorsum albido-pilosa, imo calyce marcido fulta, nuce 1–3-loculari.—Chile, in montibus Prov. Rancagua et Colchagua.—*v. s. in herb. Mus. Paris.* Rancagua (Bertero, 193).

The plant described by Dr. Clos (Gay's specimen from the same locality), and referred by him to *Retamilia*, is evidently identical with the above species, which I have characterized from Bertero's collection. I do not adopt his specific name, as all the species of *Trevoa* are spinigerous *.

4. *Trevoa Weddelliana*, n. sp.; — suffruticosa, spinosa, ramosa, ramulis teretibus, brachiatis, breviter pubescentibus, pilis patentibus; spinis decussatim oppositis, subulatis, pungentibus, divergentibus, sæpe foliosis; ramulis junioribus foliiferis et floriferis, sæpe inermibus; foliis oppositis, ovatis, integris, parvulis, vernatione complicatis, læte viridibus, subtus pallidioribus, utrinque parce pubescentibus, nervis paucis superne immersis, inferne vix prominulis, inter se arcuatim nexis et rubellis; stipulis utrinque profunde bifidis, laciniis anguste linearibus, imo petioli adnatis, rubellis, pilosulis; floribus 2–3 folio æquilongis, pedunculo imo bracteolato, calycis tubo urceolato, imo subgloboso, puberulo, limbi laciniis 5, reflexis, tubi tertia parte longitudinis, apice intus callo carinaque mediana notatis, carinis pilosulis ad basin tubi decurrentibus; petalis 5, obovatis, cucullatis, imo unguiculatis, laciniis æquantibus, erectis; staminibus iis reconditis; disco poculiformi, omnino adnato; ovario subglabro; stylo erecto, piloso, faucem tubi attingente; stigmate 3-lobo.—Bolivia, circa Chuquisaca.—*v. s. in herb. Mus. Paris* (Weddell, 1212).

This plant greatly resembles *T. trinervis* in habit, but it has much smaller leaves, and is altogether more spinose. The internodes are 8–9 lines apart; the spreading, decussating spines are about the same length; the foliiferous branchlets are from $\frac{1}{2}$ inch to $2\frac{1}{2}$ inches long, bearing about two flowers in the lower axils; the leaves are 3 lines long and $1\frac{1}{2}$ line broad, on a petiole

* A figure of this plant will be given in the same work, Plate 40 c.

of 1 line in length; the peduncle is $1\frac{1}{2}$ line long, the tube of the calyx $1\frac{1}{4}$ line long, retrorsely puberulous; the segments are $\frac{3}{4}$ line in length; the nervures within the calyx are retrorsely pilose, as in *T. trinervis*; the ovary and style are nearly glabrous, and included *.

5. *Trevoa Closiana.* Colletia tetrandra, *Clos, in Gay, Chile,* ii. 31;—fruticosa, 2-pedalis, dumosa, ramis subaphyllis, intricato-curvatis, fusco-nigricantibus, rigide spinosis, spinis decussatim oppositis, subulatis, crassiusculis, simplicibus; foliis minimis, caducissimis, lineari-oblongis, crassis, 3-nerviis, fere integris, margine obsolete crenato, superne obscure viridibus, lucidis, sparsim pilosis, subtus flavido-pallidis et dense pilosis, breviter petiolatis; stipulis majusculis, squamiformibus, imo subamplexicaulibus, valde concavis, rubris, glabris, intus parce tomentosis, 2-dentatis; floribus paucis, e gemma ad basin spinarum versus extremitatem ramorum enatis; pedunculo brevissimo, albo-tomentoso, calyce urceolato, imo extus cinereo-piloso, limbi laciniis 4, erectis; petalis 4, oblongis, valde cucullatis, unguiculatis, laciniis æquilongis, erectis, imo subcoloratis et puberulis; staminibus totidem, iis reconditis, demum inflexis; ovario niveo-piloso, sub-3-lobo; stylo brevi, tereti, pilosulo; stigmate obsolete 3-lobo.—Chile.—*v. s. in herb. Mus. Paris*; Coquimbo, in via ad Arqueros (Gay, 264).

Dr. Clos, on the authority of M. Gay, describes this as a low-growing shrub, about 2 feet high, with intricately twisted branches, which are armed with numerous simple spines, half an inch in length, and a similar distance apart. They are often leafless; the extremely deciduous leaves are very small, almost entire, or crenulated on their margin; they are linear-oblong, and 1 to 3 lines in length. The small white flowers, which become dark in drying, are 4-merous, and scarcely exceed a line in length, including their very short peduncle, and half a line in diameter. The stamens are hidden within the short cucullate petals, the anthers, after dehiscence, becoming peltate, as in the other species of the genus. It is known by its vernacular name of *Abrojo*, which in Spanish signifies a bramble. These characters are all quite in accordance with those of *Trevoa*†.

[To be continued.]

* This species will be represented in the 'Contributions,' Plate 40 D.
† A figure of this plant will be given in the same work, Plate 41 A.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Nov. 8, 1859.—John Gould, Esq., V.P., in the Chair.

Description of a New Species of Anolis from Central America. By Dr. A. Günther, Foreign Memb. Zool. Soc.

The following new species of *Anolis* was discovered by M. Sallé in Central America, and is now in the Collection of the British Museum.

Anolis sallæi, n. sp.

Diagnosis.—Snout moderately elongate and rather depressed, with the canthus rostralis sharp, and with a pair of obtuse ridges, arising from the bony superciliary margins and divergent anteriorly; a slight groove between these two ridges; the upper surface of the head is covered with small shields; occipital shield present. Loreal region slightly concave, with four series of small shields. Scales of the back, belly, and tail distinct, imbricate, strongly keeled; those of the sides very small; no trace of a crest; tail rounded, not verticillated; gular pouch small. Greyish or brownish, with a more or less distinct yellowish vertebral band; sides and belly sometimes with fine blackish longitudinal lines.

Description.—The snout is moderately depressed and slightly elongate, the distance between the anterior angles of the orbits being a little less only than that between the orbit and the extremity of the snout. The canthus rostralis is distinct and, near the orbit, rather sharp. There is another pair of low ridges, arising from the bony superciliary margin and divergent anteriorly, with a slight groove between; they extend to the middle of the length of the snout. The shields of the upper surface of the head are small, arranged in irregular transverse series, about seven in the series between the angles of the orbit; the shields along the bony superciliary margin are rather larger, but both series are separated from each other by smaller shields. An occipital shield is distinct. The nostril opens laterally, and is situated immediately behind the extremity of the snout. The labial shields are exceedingly narrow, eight or ten in number; three or four series of smaller shields run parallel to that of the lower labials, the remainder of the throat being covered with very small polygonal scales. The pouch of the throat is very little developed. The tympanum is very small. The temple and the neck are granular.

No crest whatever is visible, but the scales of the back are very distinct, imbricate, keeled; those of the sides are one-half smaller and smooth; those of the belly rhombic and distinctly keeled, rather larger than the dorsal ones. The tail is rounded, not verticillated or crested, covered with rhombic, imbricate, strongly keeled scales, the keels forming longitudinal ridges. The fore-leg does not reach to the loin, if laid backwards; it is covered with rhombic keeled

scales, and with minute smooth ones inferiorly; the fingers are slightly dilated; the fourth is very little longer than the third, then follow the fifth, the second, and the first. The hind-leg reaches beyond the tympanum, if laid forwards; it is covered with keeled scales, except the inferior and posterior sides of the femur, which are granular.

The ground-colour of the upper parts is greyish or brownish, darkest along the margins of the vertebral band; a broad yellowish or yellow dorsal band reaches from the occipital shield to the tail, where it is gradually lost. The lower parts are whitish. In one of the two specimens, the sides, the belly, and the lower part of the tail are marked with longitudinal blackish lines.

	in.	lin.
Distance between the tympanum and the extremity of the snout	0	$5\frac{2}{3}$
Distance between the tympanum and the vent	1	4
Length of the tail	4	0
Distance between the extremity of the snout and the anterior margin of the orbit	0	$2\frac{2}{3}$
Distance between the anterior angles of the orbit	0	$2\frac{1}{3}$
Length of the fore leg	0	8
——— of the hind leg	1	3

Description of a New Species of Entozoon, Sclerostoma sipunculiforme, from the Intestines of the Elephant. By W. Baird, M.D., F.L.S.

Very few opportunities, apparently, have occurred to helminthologists of examining the bodies of Elephants. In Diesing's enumeration of Entozoa found in the Mammalia, only one species is mentioned by him as having been observed and described as a parasite of this Pachyderm. This is an *Ascaris*, first mentioned by the celebrated Rudolphi as infesting the liver. The same parasitic worm has since then been found in the biliary ducts of a young Indian Elephant in America by Dr. Jackson of Boston. In his mention of this *Ascaris* (*Ascaris lonchoptera*, Diesing), Dr. Jackson states that it occurred along with numerous specimens of a *Distoma*, which he refers to the species *D. hepaticum*. The poor animal from which these worms were taken died of disease of the liver with ascites, and there was found also a large, deep, chronic ulcer in the stomach. The species here described will now make a third parasite recorded as belonging to the Elephant. I am indebted for it to Mr. Edward Gerard of the British Museum, who found it in the large intestines of a young Indian Elephant which recently died in London, after having been only a very short time in England. This animal, from Mr. Gerard's account of it, had suffered also from dropsy, as a large quantity of water escaped upon opening the abdomen.

Sclerostoma sipunculiforme, Baird.

Caput cylindricum, magnum, truncatum; oris limbo interno denticulis densis, externo aculeis majoribus numerosis, armato.

Corpus rectum, utrinque attenuatum, sipunculiforme, bursa maris triloba, lobo intermedio producto, radiis septem (quorum quinque bifurcati sunt) instructo; lobis lateralibus radiis quatuor instructis; extremitate caudali feminæ oblique truncata, subulata, apertura genitali supra caudæ apicem.

Long. feminæ 10 lineæ, long. maris 1 uncia.

Hab. In intestinis crassis Elephantis indici.

Mus. Brit.

November 22, 1859.—Dr. Gray, F.R.S., V.P., in the Chair.

Description of MacAndrewia and Myliusia, two new forms of Sponges. By Dr. J. E. Gray, F.R.S., V.P.Z.S.

In 1841 Mr. Stutchbury described in our Proceedings a Sponge in the Museum at Bristol, brought from Barbadoes, which was peculiar for being entirely formed of agglutinate silicious spicula, forming a tough semitransparent glass-like spongy mass. By exchange I have obtained half the specimen of this most curious and interesting sponge, so that I have the means of comparing those I have described with the one then made known.

In July 1851 Mr. R. MacAndrew kindly presented to the British Museum a Coral from St. Michael's, one of the Azores, which then attracted my attention, but I put it aside in hopes that I might obtain a specimen of it in spirits, which would enable me to understand more completely its history and character. No other specimen having, however, come under my examination, the subject dropped out of my mind.

It was accidentally placed with the Stony Corals, and its hardness and resemblance to the genus *Gemmipora* are some excuse for this mistake. Some time ago Mr. Holdsworth, when studying the corals in the Museum, observed that it evidently did not belong to that group: and a very superficial inspection, indeed its mere lightness, was enough to show that such was the case.

I again placed it aside, thinking that I had seen a figure of the animal as an *Alcyonium* in Messrs. Quoy and Gaimard's 'Voyage,' and in Dana's 'Zoophytes,' and that I would study it when I had that family under my hands, or leave it for some other person to examine who might take up the group.

Having lately had occasion to consult Messrs. Quoy and Gaimard's work, and the essay of Mr. Dana, I became satisfied that the substance from the Azores could not be the *Alcyonium glaucum* or *Alcyonium latum* (Dana, Zooph. 623. t. 58. f. 6), which I had before thought from recollection might be the case; for these authors describe *A. glaucum* as soft and fleshy, and *A. latum* as "more rigid in its texture than *A. glaucum*." As Mr. MacAndrew's specimen is hard, inflexible, and brittle, though very light, this induced me to examine the specimen more carefully; and I then found that the supposed coral was a silicious sponge, covered below with a thin fleshy envelope without any apparent apertures, and above with a thicker fleshy coat, studded with large-sized, regularly-disposed, cir-

cular cells, which look like the cells of the Polypes in the two *Alcyonia* above referred to. The apertures are destitute of radiating laminæ; they appear in their dry state to be subdivided into six or eight small circular tubes, and have all the appearance of being the cells of a pinnated-tentacled zoophyte. The small part of the lower surface of the spongy axis, which is exposed, is pierced with minute perforations, and the upper surface is furnished with groups of larger pores, which, as far as I can judge without injuring the specimen, are placed under the cells above described. There are grooves diverging from the small cylindrical perforations in one of the groups to the perforations in the other groups.

I have thought proper to call the genus after the gentleman who discovered it, and who has been very liberal in doing all in his power to extend our knowledge of zoology and geology, and has several times placed his yacht at the command of scientific men, to assist them in their researches.

The genus may be thus defined :—

MacAndrewia.

Cup-shaped, expanded, more or less sinuated or lobed, affixed by a more solid dilated base, covered with a fleshy bark, which is furnished with cells on the upper surface, supported by a very light porous silicious spongy cup-shaped axis, the upper surface of which is furnished with groups of small cylindrical pores placed in roses, and with grooves radiating between each group of pores; the lower surface uniformly porous.

MacAndrewia azorica.

Hab. St. Michael's, Azores, 1851 (*Robert MacAndrew, Esq., F.R.S., &c.*).

This sponge? has so much the general appearance and habit of a zoophyte with pinnated tentacles like the *Alcyonium* to which I have referred above, that I am as yet by no means certain that it may not be the product of such animals; but I have not been able to find any traces of the remains of them, and therefore must wait the arrival of some other specimen preserved in spirit to determine the fact. At the same time the bark is unlike that of any sponge that I am acquainted with, the existence of such a bark on any true sponge being as yet unknown to me. On the other hand, the existence of an axis of the spongy texture and the silicious compositions found in this marine body are novelties in the order of zoophytes in which its general appearance would lead one to place it. But that is no reason why it may not prove to be a zoophyte, as the same may be said to be the case with regard to the genus *Hyalonema*, the axis of which is so anomalous that several of the French zoologists—Valenciennes, Milne-Edwards, and others—considered the bark of it as a parasite on some unknown substance, overlooking the fact that the bark is strengthened by fibres exactly like those of which the axis is composed. Such an idea would require a belief in the

existence of two bodies always found together, and unknown in any other form, instead of their being regarded as parts of the same animal.

The axis of this body has many characters in common with the body which is called a Sponge described by Mr. Stutchbury in our Proceedings for 1841, p. 87, as mentioned above, under the name of *Dactylocalyx pumiceus*, and which has been more lately described under another name by M. Valenciennes; a very fine specimen of this is in my collection; but in this sponge it is the outer surface which is marked "with deep sinuosities radiating from the root to the outer circumference."

We have lately received from Dr. William MacGee of Belfast a very curious specimen of a silicious sponge?, which is also allied to the *Dactylocalyx* and *MacAndrewia*, but so distinct in its form and structure that I am inclined to regard it as the type of a new genus, which may be called

Myliusia.

Sponge? silicious, funnel-shaped, fixed by the base; the upper surface smooth, marked with numerous minute perforations placed in nearly parallel grooves radiating from the centre to the circumference, and with numerous large, oblong, rather unequal-sized perforations, which are fringed on the lower side with a high wall of a similar structure to the rest of the sponge; these edges of the cavities causing the under surface to be covered with unequal irregular shaped tubes of nearly the same length, and more or less confluent together: some of these tubes are simple and subcylindrical, others are expanded and more or less crumpled on the edge around the cavity, so as to end in two, three, or even four, more or less circular mouths.

Myliusia callocyathes.

Hab. West Indies (*Dr. MacGee*).

Dr. Bowerbank informs me that the silicious spicula of this sponge are very different from those of *Dactylocalyx pumiceus*. As he is working on that subject, I leave the peculiarities for him to describe; but I should not be in the least surprised if the genera *MacAndrewia*, *Myliusia*, and *Dactylocalyx* should all prove to be a peculiar family of zoophytes rather than sponges. If these bodies are sponges, they will form a family in that group, which may be named *MacAndrewiadæ*, characterized by the peculiar form and structure of the axis, the distinctness of the bark, and the position of the oscules or cells.

The structure of the base of *Dactylocalyx* and of the spicula which are found in the interspaces of the network are figured by Mr. Quekett in his 'Lectures on Histology.'

I have named this genus after Christlob Mylius, who first described the curious zoophyte since called *Umbellularia grœnlandica*; and I think that any one who reads his simple and plain account of the animal in his letter to Haller, and the account of the same

animal given by John Ellis in his work on Corallines, will be satisfied that the latter was not very liberal in his praise towards his contemporary. There might have been reasons why he did not mention the name of Mylius, but I cannot conceive why those of Collinson and Dunze should have been omitted.

On two new Birds from the Rio Napo. By Philip Lutley Sclater, M.A.

Buarremon castaneiceps.

Saturate oleagineus, subtus vix dilutior: remigibus et rectricibus nigricanti-fuscis: pileo castaneo, lateribus capitis cum gula nigricanti-cinereis: rostri nigricanti-plumbei basi pallida; pedibus nigris.

Long. tota 6·5, alæ 3·1, caudæ 2·6.

But one example of this *Buarremon* was in the collection. It may be arranged next to *B. rufinuchus* and *B. latinuchus*, from which, however, it is easily distinguished by its general deep olive colouring.

Grallaria nuchalis.

Saturate brunnescenti-oleaginea, pileo rufescentiore, nucha et regione post-oculari clare castaneis: subtus nigricanti-schistacea: rostro et pedibus nigris.

Long. tota 7·5, alæ 4·5, caudæ 2·1, rostri a rictu 1·2; tarsi 2·15.

This bird is a long-legged *Grallaria* in structure, though in plumage it rather resembles the different species of the allied genus *Formicarius*. I have never seen but this one example, now in my collection.

Remarks on the Habits of a Herring Gull (Larus argentatus). By A. D. Bartlett.

In calling attention to the singular and remarkable habits of a bird of this species, permit me to give an extract from the 'Garden Guide' of 1852, in order that the origin of this individual specimen may be perfectly known.

"In the beginning of June 1850, a Herring Gull (*Larus argentatus*) hatched out her young ones in the enclosure (No. 17), which is overshadowed by two weeping ash trees. The male bird had assisted her so constantly in incubation, that his strength gave way, and he died just as the young birds were chipping out of the shell. The female then became restless, left the eggs, and was only induced to resume her place for the few hours which were necessary to complete the hatch by the keeper having arranged the dead body of her mate in counterfeit presentment of the position he generally took up near her when not himself upon the eggs."—*Extract from 'Garden Guide,'* 1852

It will, I hope, be understood that the birds so hatched in 1850 were the parents of the individual whose habits I now wish to record.

This bird was one of two hatched about the latter end of May 1857, and was reared by its parents in the gardens, where it remained during the summer and autumn of that year. At the commencement of the winter he was in the habit of flying about (not having been pinioned), and occasionally staying away a *day* or *two*, then *for a week or more*, returning again generally about feeding-time, and alighting among the other gulls and feeding with them. This continued till the end of March 1858, at which time he disappeared. Nothing more was seen or heard of him until the middle of November 1858, when, to the delight and astonishment of all who knew him, he returned one afternoon at the usual time. *Meeting the keeper with the box of food, he followed him* to the enclosure where he was hatched, and settling down among the other gulls, took his dinner as though he had never been away, not appearing the *least shy or wild.* Here he remained with his parents and the other gulls, occasionally flying off for a *day* or *two,* until the beginning of February 1859.

He again departed and by many was given up for lost; others, however, thought he might again return. And on the morning of *Saturday last, between eight and nine o'clock,* we were gratified to behold the long-lost Gull making his way to his old quarters much improved in his appearance, having nearly completed his adult plumage. He immediately came down and was greeted by his old friends, who evidently recognized him. He *appeared fatigued and hungry*: I sent for some food, and he came boldly towards us, and fed almost from the hand. As soon as his appetite was satisfied, he walked about, quite at home among the other gulls. Since Saturday I have seen him flying now and then over the Gardens and Park, but returning after a short flight.

In conclusion, I beg to say I am indebted to one of the Society's most careful and very intelligent keepers (B. Misselbrook) for some of the facts which have enabled me to bring before you these very interesting particulars.

On the most efficient Means of preserving the Eggs of Birds in order that they may be afterwards hatched. By A. D. Bartlett.

I believe there are but few persons who are quite satisfied by seeing and examining the dried skins and feathers of birds.

The great desire, therefore, to see, or to possess, in a living state, these wonderful and generally beautiful creatures, has led me to consider the possibility of preserving their eggs for a sufficiently long period to allow of their being brought from distant places and afterwards hatched. We might thus be able to obtain some of the more delicate species, and many perhaps that a long sea voyage would prevent our obtaining by any other means.

The mere keeping fresh and sweet the eggs of birds has been accomplished in many ways: for instance, they will keep for a long period imbedded in lime and water, or in fat or salt; but by these means the vitality is destroyed. It appears to me, therefore, to be essentially necessary, not only to prevent evaporation, but also to

keep the texture and surface of the shell in its pure and perfect condition. To accomplish this object the eggs must be newly laid, or nearly so, and the following is the best method of preserving them.

Obtain the gut of any animal whose intestine is large enough to admit the egg intended to be preserved, and, having carefully cleaned the gut and rendered it free from fat, dry it as much as possible in powdered chalk or other earthy matter. Pass the egg into the gut, tying it close to the shell at both ends of the egg, and hang it up in a *cool, dry place* until it is quite dry. Two, three, or more eggs can be tied in the same gut like a string of beads, or they can be tied separately. When thoroughly dry, they may be packed up in a box with oats, wheat, or any *other dry grain or seeds*, until the box is quite full. The object in having the box full is for the great convenience of turning the eggs. This is accomplished by turning the box bottom upwards, which should be done occasionally. Thus the whole of the eggs may be effectually turned with very little trouble. The eggs thus packed must be kept in a dry, cool place, and ought not to be taken out or unpacked before the means are at hand for hatching them. Upon wishing to place them under a hen, or otherwise, if the dry gut be cut with a sharp knife, it will peel off without in any way injuring the shell of the egg.

I was successful in hatching and rearing the young from some eggs kept three months in this manner, and I have no doubt that under favourable circumstances they may be kept for a longer period.

December 13th.—Dr. Gray, F.R.S., V.P., in the Chair.

Description of a New Species of Squirrel (Sciurus siamensis) from Siam, in the Collection of the British Museum. By Dr. J. E. Gray, F.R.S., V.P.Z.S.

Among the animals lately sent by M. Mouhot from Siam are two small Squirrels, which differ from any that we have hitherto received from India or the neighbouring countries.

I am aware that the Indian Squirrels, and indeed Squirrels generally, are very apt to vary; and probably many more species are described than exist in nature; but I do not know any species of which the one now described can with reason be considered as a variety; the two specimens in the Museum are very uniform in their general appearance.

It may be observed that some species, both of Mammalia and Birds, are so much alike in external appearance, that, judging from their skins alone, we might be inclined to doubt whether they were more than slight varieties; yet when their habits, modes of life, food, and manners are known, they are far more distinct, as species, than animals which are very different in their external appearance, and marked with what might *a priori* be considered very striking characters.

Sciurus siamensis, sp. nov.

Bright red-brown, grizzled with elongate black tips to the longer

hairs, each of which is marked with a broad subterminal yellow band. These black hairs are more abundant, and have broad pale rings on the rump outside of the thighs, and especially on the lower part of the tail, where they nearly hide the general red colour. The terminal half of the tail bright chestnut-brown, without any black hairs or pale rings. The throat, breast, belly, lower part of sides, inner side and edge of the legs, uniform bright red-brown. Ears rounded. Whiskers black. Feet covered with short close-pressed hairs.

Hab. Siam (*M. Mouhot*).

Description of a New Species of Freshwater Tortoise from Siam. By Dr. J. Edward Gray, F.R.S., V.P.Z.S.

The British Museum has received from M. Mouhot, with some other Reptiles, two specimens of a Freshwater Tortoise, which are decidedly different from any I have before seen. They have somewhat the external appearance, both in shape and markings of the head, of some specimens of *Cistudo amboinensis*, but belong to the genus *Emys*, or rather *Geoclemys*, and not to *Cistudo*.

They are referable to the first division of genus which has the back of the shell three-keeled, and, like the other species of that section, come from Asia.

Geoclemys macrocephala.

The shell oblong, rather depressed, entire, three-keeled, olive-brown; the keels subcontinued, nearly parallel, the middle one higher and more distinct behind; the lateral ones, near the upper edge of the shields, continued, ending abruptly on the hinder edge of the third lateral discal shield; the hinder lateral and central shield only marked with a slight convexity; the margin entire, yellow-edged. The under side yellow, with black triangular spots; the sternum flat, very indistinctly keeled on the side.

Animal blackish-olive. Head large; crown flat, covered with a single smooth plate, purplish-brown, with two streaks from middle of the nose, the upper edging the crown, the other the upper part of the beak, and with two streaks from the hinder edge of the orbit, the lower short and interrupted, extended on the temple, the upper broader and continued over the ear along the side of the neck; two close streaks under the nostrils to the middle of the upper jaw, and two broad streaks, dilated behind, down the front of the lower jaw, and continued on the edge of the lower jaw behind; the nape and hinder part of the side of the lower jaw covered with large flat scales; the rest of the neck and legs covered with minute granular scales; the front of the fore-legs covered with broad band-like scales; the toes of the fore- and hind-feet rather short and thick, covered above with broad band-like scales.

Hab. Siam.

The front vertebral plate is quadrangular, the front edge wider, rounded; second, third, and fourth ventral shields six-sided, the second longer than broad, the fourth broader than long; the three

hinder sides are longest, the fifth vertebral shield subquadrangular, the front sides being very narrow, and the hinder side very broad and slightly truncated.

On two New Species of Cinclus. By John Gould, F.R.S., etc.

I have the pleasure of bringing before the notice of the meeting two new species of *Cinclus*, for the knowledge of which science is indebted to the researches of Dr. A. Leith Adams, who collected them in Cashmere. The first of these, which is very nearly allied to our well-known *Cinclus aquaticus*, I propose to characterize as *C. cashmeriensis*; the other, which is more nearly allied to *C. Pallasi*, as *C. sordidus*.

The following are descriptions of these two birds:—

Cinclus cashmeriensis.

Crown of the head, ear-coverts, and mantle brown, passing into deeper brown on the upper part of the back and wing-coverts; lower part of the back and tail-coverts grey, with a darker central mark on each feather; tail blackish grey; wings the same colour as the tail; throat and breast white; upper part of the abdomen brown, passing into dark greyish-brown on the flanks and vent; under tail-coverts uniform dark grey; tarsi brown, lighter on the front and on the upper part of the toes.

Total length 7 inches; bill $\frac{7}{8}$; wing $3\frac{7}{8}$; tail $2\frac{1}{4}$; tarsi $1\frac{1}{8}$.

Hab. Cashmere.

Remark.—As compared with adult males of the *C. aquaticus*, this bird differs in being considerably larger in size, and in wanting the rich chestnut colouring of the upper part of the abdomen; the wings exceeding in length those of its European ally by more than half an inch.

Cinclus sordidus.

Crown of the head, back of the neck, throat, and chest chocolate-brown, the throat and breast being lighter than the back of the head; back, abdomen, and tail deep brownish-black, the abdomen somewhat the darkest; wings nearly the same colour as the back; tarsi brown, lighter on the front and on the upper part of the toes.

Total length $6\frac{1}{4}$ inches; bill $\frac{7}{8}$; wing $3\frac{1}{4}$; tail 2; tarsi $1\frac{1}{8}$.

Hab. Cashmere.

Remark.—If it were possible to conceive a cross between *C. aquaticus*, or *C. cashmeriensis*, and *C. Pallasi*, the produce would, I should say, be a bird like the one under consideration. I do not, however, believe that any such occurrence has taken place, but that the bird characterized as *C. sordidus* is a good species. In size it is smaller than *C. aquaticus*; at least the measurements of the only example I have seen induce me to believe so.

MISCELLANEOUS.

Investigation of Trichina spiralis. By R. Leuckart.

Professor Leuckart has communicated the following results of his investigation of *Trichina spiralis* to the Royal Academy of Sciences of Göttingen :—

1. *Trichina spiralis* is the young state of a hitherto unknown small Nematode worm (of 1·5–2·8 mill. in length), for which the generic name *Trichina* must be retained.

2. It inhabits the intestinal canal of numerous warm-blooded animals, not only Mammalia (dogs, cats, pigs, sheep, rabbits, and mice, —also, undoubtedly, man), but also Birds (the common fowl), and indeed always in large quantity.

3. The intestinal *Trichina* attains its full sexual maturity as early as two days after its immigration.

4. The eggs of the female are developed in the vagina into minute *Filaria*-like embryos, which are extruded without egg-shells (from the sixth day onwards).

5. The new-born young immediately set about their migration. They penetrate the wall of the intestine, and pass through the cavity of the abdomen directly into the muscular envelope of their host.

6. The course upon which they advance is indicated beforehand by the intermuscular masses of cellular tissue.

7. The majority of the migrating embryos remain in the groups of muscles immediately inclosing the cavity of the body (the abdominal and thoracic cavities), especially the smaller ones and those containing most cellular tissue.

8. The embryos penetrate into the interior of the individual muscular fasciculi, and here attain, within fourteen days, the size and organization of the well-known *Trichina spiralis*.

9. The infected muscular fasciculus loses its previous structure immediately after the penetration, the fibrillæ becoming broken up into a finely granular substance, and the muscular corpuscles acquiring the form of oval nucleated cells.

10. Up to the full development of the *Trichina spiralis*, the infected muscular fasciculus still retains its original tubular form; whilst subsequently its sarcolemma thickens and it becomes gradually shrivelled from the extremities.

11. The spot occupied by the parasite persists, in the form of a spindle-shaped enlargement, in which the well-known lemon-shaped or globular calcareous shell is afterwards deposited (although only after a long time).

12. The migration and development of the embryos take place also after the transference of pregnant *Trichinæ* into the intestine of another (suitable) host.

13. The further development of the *Trichina spiralis* into the sexually mature animal is quite independent of the formation of this calcareous shell, and takes place as soon as the young state is fully developed.

14. Male and female individuals are distinguishable even in the young state (*Trichina spiralis*).

15. The immigration of the brood of *Trichina* in large quantities causes very serious symptoms: namely, peritonitis, in consequence of the penetration of the wall of the intestine by the embryos; and lameness, in consequence of the destruction of the infected muscular fasciculi.

16. Feeding upon flesh containing *Trichinæ* is also followed by more or less dangerous symptoms, according to the quantity of the imported parasites; namely, an enteritis, often causing death, accompanied by bloody (*crupöser*) exudations, which are sometimes thrown down in ragged clots and evacuated (rabbit), and sometimes converted into psorospermia (dog), or pus-corpuscles (cat, mouse).—*Göttinger Nachrichten*, April 30, 1860, p. 135.

SERTULARIA TRICUSPIDATA.

To the Editors of the Annals of Natural History.

Gentlemen,—Allow me to thank Prof. Greene for pointing out the pre-occupation of the specific name of the above species by Mr. Alder, which had escaped my notice.

With his permission, I shall alter the name to *Greenei*, in honour of one of such high promise in our favourite science.

I am, Gentlemen, Your obedient Servant,
Andrew Murray.

On the Strobilation of the Scyphistomata. By P. J. Van Beneden.

Professor Van Beneden has long held, in common with Desor, and in opposition to Sars, that the Medusæ are produced from *Scyphistoma* by the formation of a series of buds in the vicinity of the mouth of the latter; whilst Sars maintained that the Strobile was produced by a transverse segmentation of the body of the *Scyphistoma*. The latter has been the view most generally received amongst naturalists, and Professor Van Beneden now gives in his adherence to it in consequence of some recent observations which he has had the opportunity of making.

The development of *Cyanæa* takes place, according to him, in the following manner:—The *Scyphistoma* produces no buds; but a part of its own substance becomes converted into Medusæ. The terminal segment, bearing the arms, does not detach itself in the form of a *Scyphistoma*, to go and live elsewhere, but it becomes a Medusa like the others, and the arms are absorbed in proportion as the Medusal form makes its appearance. The peduncle of the Strobile exhibits a *fresh* crown of tentacles before the first Medusæ are detached. The terminal Medusa, bearing the tentacles which are absorbed, and retaining the mouth of the *Scyphistoma*, consequently does not pass through the same phænomena of evolution as the other Medusæ.—*Bull. Acad. Roy. Belg.* 2me sér. tome vii.

On the Seminal Fluid and Fecundation in the Arachnida. By Emile Blanchard.

The generative organs in the Arachnida are formed upon a peculiar plan, which is reproduced, with moderate modifications, in almost all the types of that class of animals.

The female organs are composed of membranous tubes presenting vesicles or cells in their course; the quantity of these cells is more or less considerable, and in them the eggs are developed. These tubes, usually two in number, terminating in a blind extremity, are generally of great size; this is the case in the Araneida and Tetracera (*Galeodes*). In the *Phalangia* and *Cheliferi* they are united by their posterior part so as to form a ring. In the Scorpionida they have a peculiar arrangement, so well known that I shall not dwell upon it. But in all cases they serve at once as oviducts and as reservoirs of the seminal fluid. An observation of this nature, and various experiments, enabled me to show that it was to the preservation of the semen of the male in the ovarian passages, and not to a parthenogenesis, as has been supposed, that we must attribute the faculty indicated with regard to Spiders in captivity, of remaining fertile for several years without copulating. The eggs are developed in the vesicles or cells formed by the expansions of the ovarian ducts; the vesicles being constricted at their origin, the seminal fluid never penetrates into them; and it is only when the ova, being arrived at maturity, have just passed into the oviduct, that they are impregnated. In the viviparous Arachnida, such as the Scorpions, in which the embryos are developed within the ovarian cells, impregnation nevertheless only takes place at a certain epoch,—namely when the egg has become large enough to dilate the walls of the entrance of its cell sufficiently to allow the passage of the fertilizing fluid. In *Phalangium* and *Chelifer* the female apparatus is still more complicated: there exists a true uterus, in which the eggs must remain for a time before being expelled.

The female apparatus of many Araneida, especially of those species which live only one season, consists simply of the ovarian tubes united near the orifice so as to form a short common oviduct; but in those Araneida whose existence is prolonged for several years, and whose fecundity must persist after a single copulation (*Segestriæ*, *Dysderæ*, &c.), there is a special reservoir, a sort of copulatory sac with fibrous walls opening outwards with the common oviduct, and thus arranged to receive the liquid of the male directly during copulation.

In these Araneida, also, the seminal fluid presents a remarkable character. Whilst in the Arachnida generally (in the Araneida, Scorpionida, and Phalangiida) we see, swimming in this fluid, filiform spermatozoids and the little vesicles in which, as we know from the observations of Kölliker, Wagner, and others, the spermatozoids are formed, we find in the *Segestriæ*, *Dysderæ*, &c., bodies of the form of a flattened sphere, very regular, and so large that, when a

little drop of the fluid is spread upon a glass plate, a multitude of small granules are perceived by the naked eye. These granules, or rather capsules, measure from $\frac{1}{100}$th to $\frac{1}{50}$th of a millimetre. Under a magnifying power of 300 to 400 diameters, an immense quantity of filiform spermatozoids, regularly disposed from the centre to the circumference, may be distinguished in their interior. By compressing one of these capsules with a plate of thin glass, it is made to burst, and then the spermatozoids escape, animated by movements which leave no doubt as to their nature.

The ordinary small vesicles in which the spermatozoids are formed continue their development here by increasing considerably in size, and thus become to a certain extent spermatophora. These corpuscles are all found in the same state during a great part of the year, both in the seminal receptacles of the females and in the testes and the copulatory joints of the palpi of the males. At the period when the eggs are to be fertilized, the spermatophorous capsules burst, and then, the spermatozoids being set free, the seminal fluid presents its ordinary aspect.—*Comptes Rendus*, April 9, 1860, p. 727.

Note on the Larva of a Nematode Worm, and on some remarkable peculiarities of the Generative Organs in the Nematoda. By A. Schneider.

M. Schneider calls attention to a sort of alternation of generations in a Nematode worm, which he calls *Alloionema appendiculatum*. In the Black Slug (*Arion ater*) he found the larva of a Nematode worm, possessing neither a mouth nor an anus, but simply the rudiments of an intestinal canal and of generative organs. This larva is further characterized by the existence of a curious appendage on each side of the posterior part of the body. When these larvæ are placed in animal matter in a state of decomposition, they become developed, acquire a mouth, and attain their sexual maturity. These animals then propagate during a great number of generations, but without passing again through the larval phase observed in the *Arion*.

Another interesting discovery of M. Schneider's is that of a hermaphrodite Nematode worm, the first with which we are acquainted. He gives it the name of *Pelodytes hermaphroditus*. This animal occurs in the larval state in Snails. When an individual is placed by itself in a watch-glass with animal substances in a state of decomposition, it soon attains its sexual maturity. Spermatozoids are first seen to make their appearance in the generative tube, and then eggs; fecundation takes place, and a new generation is brought forth. To those who know the perfect similarity which exists between the evolution of ova and that of spermatozoids in the Nematoda, this fact, notwithstanding the great interest attaching to it, cannot be surprising.—*Siebold und Kölliker's Zeitschrift*, 1859, p. 176.

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END OF THE FIFTH VOLUME.

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